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## The effects of aerobic activity on the self-stimulating behaviors of children diagnosed with autism

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THE EFFECTS OF AEROBIC ACTIVITY ON THE SELF-STIMULATING  
BEHAVIORS OF CHILDREN DIAGNOSED WITH AUTISM

An Abstract of a Thesis  
Submitted  
In Partial Fulfillment  
Of the Requirements for the Degree  
Specialist in Education

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University of Northern Iowa  
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This Study by: Jason Witte

Entitled: The Effects of Aerobic Activity on the Self-Stimulating Behaviors of Children Diagnosed with Autism

Has been approved as meeting the thesis requirements for the  
Degree of Specialist in Education

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## CHAPTER 1

### INTRODUCTION

As a formally defined disorder, autism has not had much recognition (Rapin, 1997). Autism was first thought to be a form of schizophrenia. Ernst Blueler, a Swiss Psychiatrist in 1911, described severe schizophrenia as characterized by detaching from the world and interacting very little with the outside world. Blueler felt the disorder he was witness to was just another characteristic of childhood schizophrenia, and not a distinct disorder standing on its own (Bronson, 1999).

It was not until 1943 that Leo Kanner first systematically researched the disorder of autism. Kanner published research on 11 children who displayed characteristics of extreme aloneness, repetitive and stereotyped behaviors, delayed speech; lacked the ability to relate to people; were happiest when left alone; failed to develop usual social awareness; with all the children manifesting these characteristics at the beginning of life (Kanner, 1943). Kanner felt that this was not a form of childhood schizophrenia, but instead clearly a distinct disorder all its own. He reported that the children's inability to relate to people and situations in the normal way from the beginning of life is not the withdrawal from a preset relationship. From the beginning of life, the children displayed an autistic aloneness that shut out anything that came from the outside.

Many professionals agreed with Kanner's identification of a distinct disorder. Rimland (1965), as cited in Kanner (1965), stated that there is sufficient information to make the claim that autism is a separate and distinct disorder from what is known as schizophrenia. Volkmar (1987) stated that medical and limited genetic studies

conducted suggest that autism is indeed a separate and distinct disorder from schizophrenia. The Diagnostic and Statistical Manual of Mental Disorders 4<sup>th</sup> Edition (DSM-IV) suggested that autism is distinct from a number of disorders, schizophrenia, receptive language disorder, and expressive language disorder (APA, 1994).

Autism is a disorder that is very hard for family and caretakers to understand and treat. Children with autism, unless also affected with other disabilities, have no physical anomalies that distinguish them from their peers (Kanner, 1943). Autism holds worldwide recognition, crossing the boundaries of sex, culture, religion, ethnicity, and socioeconomic status (Mehl-Madrona, 2000a). Autism affects 2-5 in 10,000 births, with a 4:1 ratio of males having the disorder more often than females (APA, 1994). Autism is the type of disorder where the characteristics of the disorder bind the population as a whole and yet are so unique as to how each and every person diagnosed with autism expresses the characteristics. If there are 10 children diagnosed with autism in the classroom, an observer will clearly see 10 different types of autism being expressed.

The Diagnostic and Statistical Manual of Mental Disorders 4<sup>th</sup> Edition (DSM-IV) has placed autism under the category of Pervasive Developmental Disorder (PDD). Also under the umbrella of PDD are the disorders of Asperger's Disorder, Rett's Disorder, Childhood Disintegrative Disorder, and PDD not otherwise specified (APA, 1994). The core symptoms of the disorder of autism are impairment of social interaction, impairment in verbal and nonverbal communication, and a restricted repertoire of activities and interests (DeLong, 1999). Rapin (1999) states other

symptoms of the disorder may be high anxiety, poor cognitive flexibility, rigidity, and perseveration.

### Causes

Since the cause of autism is unknown there is continuing professional debate as to the true cause of the disorder. Many professionals believe that if the cause of the disorder were to be known, it would make the formula for treatment more apparent. Some of the hypothesized causes of the disorder are genetics (Szatamari, Jones, Zwaigenbaum, & MacLean, 1998), abnormalities in areas of the brain (Rapin, 1997), neurotransmitter abnormalities (Murray, 1996), viral infections, toxins, temperature fluctuations, obstetric complications (Landau, Cicchetti, Klin, & Volkmar, 1999), increased maternal age, low birth weight, or use of medication during pregnancy (Cryan, Byrne, O'Donovan, & O'Callaghan, 1995), and environmental complications (defined by the Autism Society of America as anything producing structural or functional damage to the central nervous system; Freeman, 2000).

### Specific Behaviors

Rimland (1964) as cited in Watters and Watters (1980) defines self-stimulating behavior as a defining characteristic of autism and may include such behaviors as rocking, hand-flapping, mouthing, and spinning objects. The term self-stimulating behavior is also known as stereotypic behavior, stereotyped movements, repetitive behavior, or autistic mannerisms (Kern, Koegel, Dyer, Blew, & Fenton, 1982). Professionals see self-stimulating behaviors as a defining characteristic of autism (Margolies, 1977), and may include such behaviors as rhythmic rocking,

repetitive jumping, arm flapping, floor pacing, object spinning, hand staring, eye rolling or crossing, and toe walking (Cushings, Adams, & Rincover, 1983), as cited in Levinson and Reid (1993).

Self-stimulation (e.g., body rocking, hand flapping) has been identified as a primary characteristic of autism (Kanner, 1943; Lovaas, 1967; National Society for Autistic Children, 1978; Rimland, 1964; Rutter, 1966a; Wing, 1966). These stereotyped repetitive behaviors appear to have no functional purpose in the environment other than to provide the individual with sensory feedback (Hutt, Hutt, Lee, & Ounsted, 1965; Lovaas, 1967) and have been observed in 63-73% of autistic and retarded individuals (Berkson & Davenport, 1962; Kaufman & Levitt, 1965; Rutter, 1966a). (cited in Chock & Gland, 1987, pp. 365)

Risley (1968) hypothesized that self-stimulating behavior may be functionally incompatible with the learning of new behaviors, as cited in Chock and Glahn (1983).

The self-stimulating behavior has been shown to interfere with learning and socially appropriate behaviors. Koegel and Covert (1972) and Chock (1979) found that severely autistic children with self-stimulating behaviors had trouble learning even the simplest tasks due to the fact they were so engaged in self-stimulation as cited by Kern (1982).

Research has shown that self-stimulating behaviors co vary with other behavior. For example, Epstein et al., 1974 and Koegel et al., 1974 showed that as self-stimulating behaviors have been depressed, play skills have increased, as cited in (Kern, Koegel, Dyer, Blew, & Fenton, 1982). "The distinctive maladaptive behaviors and stereotypic mannerisms often associated with autism create a special barrier to integration (Hill & Bruininks, 1984; Repp & Deitz, 1974; Scheereberger, 1981;

VanBourgondien & Mesibov, 1989)” as cited in Elliott, Dobbin, Rose, and Soper (1994) p. 566.

The behavior of the children in Kanner’s original study was characterized as stereotyped and repetitive behaviors that served no function what so ever, other than to be self-stimulating. A behavior seen to couple the stereotyped behaviors was that of the children’s desire for sameness. Should the environment or schedule of these children be rearranged or have to be changed it would be very upsetting and would set the children into a fit of despair, sometimes resulting in physically violent displays of aggression until the sameness was restored (Kanner, 1943). Aggressive behaviors may be displayed when caretakers try to interrupt or change the routine of a child diagnosed with autism (Rapin, 1997). When the ritualistic behaviors of children with autism are interrupted it is very upsetting to them, and the only way that some know how to react to the interruption is by directing the aggressive behavior towards caretakers or themselves, which is self-injurious behavior (Rapin, 1997).

Stereotyped behaviors that are present in some children diagnosed with autism are that of hand flapping, spinning, running in circles, twirling objects, tearing paper, and drumming (Rapin, 1997). Other stereotyped behaviors that may be expressed by children diagnosed with autism are oral stereotypes, portrayed as humming, beeping, screaming, incessant questioning, and a singsong voice where all words are set to a song like voice. The repetitive behaviors of children diagnosed with autism may function as a calming agent as a way to express their emotion, or to help block out unwanted stimuli. Large portions of the autistic child’s day may focus on self-stimulation (Mehl-Madrona, 2000a).

### Types of Treatments

To this date there is no known cure for autism. Current treatments available are designed only to alleviate some of the symptoms, are far from a cure, and encompass a broad range of effectiveness and notoriety. Parents need to be well educated on the type of treatments available for their child. The disorder of autism is such a severe disorder with so few answers to so many questions that parents may have a tendency to latch on to any and all treatments promising a reduction in, or cure for the symptoms of autism (Smith, 1996). Treatments selected for a child diagnosed with autism should be based on established effectiveness, published in professional journals (Smith, 1996). The current therapies deployed on children diagnosed with autism include behavior therapy, communication therapy, social skills therapy, facilitated communication, sensory integration, auditory training, diet/vitamins, medications, music therapy, educational therapy (Autism Society of America web site, 2000e), homeopathic therapies, immunotherapy, antiviral therapy, naturalistic behavior therapy, body therapy, manipulative therapy (Mehl-Madrona, 2000b), Sensory Integration Therapy, Gentle Teaching, deep pressure therapy, psychotherapies, and animal therapy (Green, 1996).

A therapy that has been researched by professionals for years is the use of exercise for the alleviation of symptoms in people diagnosed with autism. Specifically, professionals have researched the treatment of exercise as a possible means to reduce the self-stimulating behaviors of people diagnosed with autism (Chock & Glahn, 1983; Elliot et al., 1994; Kern, Koegel, & Dunlap, 1984; Kern et al.,



1982; Koegel & Covert, 1972; Levinson & Reid, 1993; Lovaas, Newsom, & Hickman, 1987; Rosenthal-Malek & Mitchell, 1997; Watters & Watters, 1980).

Tkachuk and Martin (1999) report on Sime's (1996) published list of considerations for professionals to follow when using physical fitness as a therapy:

1. Review the exercise history of the person to determine any exercise habits or preferences.
2. Participate in the initial exercise session, modeling the behavior.
3. Educate the client about the physical and mental benefits of exercise.
4. Think of ways to make exercise functional, such as walking to work, or taking the stairs.
5. Take advantage of the person's environment.
6. Help the client choose enjoyable activities.
7. Prescribe the type, duration, frequency, and intensity of the exercise in relation to the person's current physical condition.
8. Facilitate exercise with a positive social milieu.
9. Help the person develop behavioral self-control strategies.
10. Prepare the client for recidivism and reinitiation.

Autism is a disorder that has many unique characteristics and aspects to it. People diagnosed with autism may have difficulties with social and communication skills, and may engage in restrictive and repetitive patterns of behavior (APA, 1994; Rapin, 1997, 1999). The symptom of self-stimulation and the effects aerobic exercise has on the self-stimulating behaviors of those diagnosed with autism is the focus of this current study.

### Purpose

The literature on the efficacy of aerobic exercise on the diminution of self-stimulation in children who also have autism was mixed. However the majority of the published work supported an interpretation that aerobic exercise immediately prior to academic task activity can reduce self-stimulation and increase engagement.

However, since the research results were mixed, it was appropriate to continue researching the effects of aerobic activity on self-stimulation and engagement in children with autism. The purpose of the current study was to continue the research needed to answer the question of the efficacy of aerobic exercise in reducing self-stimulation and increasing engagement in academic tasks.

### Rationale

Since autism has no known cause or cure, it lends itself to a multitude of treatment strategies, each of which has some research support for efficacy. Each treatment has worked for some sample. However there does not appear to be a treatment that can be generalized to all children having autism. Information on treatment efficacy is vital for family members and other caregivers who must devise treatment programs.

While aerobic activity has been used as an effective treatment, it has not been without mixed results. Since aerobic activity is physically and psychologically challenging for many individuals without a handicapping condition, it is not surprising that such activity is even more challenging for individual with a handicapping condition. The challenge is particularly demanding of children with autism due to the fact the children may not understand why they have to participate in

such a demanding activity. Forcing an individual to participate in a treatment the individual does not care for and then obtaining only minimal benefits does not provide much benefit to anyone. Thus knowing the limits of any treatment is necessary for appropriate program design.

When one asks what utility the self-stimulating behavior would have for the person with autism, it is possible that the behavior serves several functions. It could be used as an anxiety reducer, as a substitute for another behavior like writing, a simple follow along with thinking, an attempt to get attention, as a way of getting out of a boring or too difficult assignment, etc. Regardless of the utility, however, the behavior does appear to be one that interferes with socialization and learning processes. If a treatment can be found that reduces the behavior, it should be possible for the person to concentrate better on other tasks and to be more successful in attaining requisite skills. If aerobic activity would truly reduce self-stimulation and increase engagement in subsequent academic tasks, it would be an easy treatment to integrate in a school program.

### Limitations

One specific limitation was the amount of time it took to collect all the data for each individual child. Each child had to be placed through the treatment portion of the study and then observed immediately after the treatment phase, making the collection of the data for an entire day a long process. It was thought that the results obtained would be stronger if the children were placed through the treatment phase and observed individually. Group administration of the aerobic activity would not

guarantee that each child would actively participate. Only one researcher was available for the administration of the treatment and the observation afterwards.

A second limitation of the study was that the research was conducted on children expressing predominantly motor self-stimulating behaviors. Additional research is needed to assess the effects aerobic activity may have on a population of children diagnosed with autism displaying predominantly vocal or verbal self-stimulating behaviors. The small sample size of the current study, coupled with the results of the current study would have limited generalizing potential, specifically those children diagnosed with autism who display predominantly motor self-stimulation.

A third limitation of the study was that the long-term effects of aerobic activity on reducing the self-stimulating behaviors of children diagnosed with autism have provided poor results in past professional literature. Professionals reported that the termination of aerobic activity resulted in a return to previous levels of self-stimulating behaviors, and for some children, an increase in self-stimulating behaviors was reported.

A fourth limitation was the age of the participants in the study. The current study looked at children all above the age of nine. More research is needed in younger age ranges to appropriately assess the effects aerobic activity may have on the self-stimulating behaviors of children diagnosed with autism. The limited age range of the current study also reflects the limited generalizing potential of the current study's results.



### Organization of the Paper

The paper will begin with a brief summary of the definition, causes, and treatments for autism. The paper provides a review of the professional literature on the effects of exercise on mental health and mental health processes, its effects on those with disabilities, and on the effects aerobic activity has in reducing the self-stimulating behaviors of those diagnosed with autism. Following a review of the professional literature, a description of the methodology and procedures of a research study is discussed. The research study was designed to observe the effects aerobic activity has on the self-stimulating behaviors of children diagnosed with autism in a self-contained school setting.

## CHAPTER 2

### LITERATURE REVIEW

The following is a representation of professional literature in regards to the topic of autism and the definition, causes, and treatments for the disorder. After the introduction, an extensive review of the professional literature is provided in regards to the effects of exercise on mental health and mental processes, its effects on those with disabilities, and on reducing the effects of self-stimulating behaviors in those diagnosed with autism. The articles are arranged throughout the individual subheadings in order of importance. Articles that have made important contributions to the professional literature, through research design or findings of the research, have been placed in the earlier portions of the separate subheadings.

#### Effects of Exercise on Mental Health and Mental Health Processes

##### Mental Health

Research on the benefits of exercise on mental health have been limited due to the fact that many professionals see the mind and body as being separate, and having few conceptual links between the two (Folkins & Sime, 1981). However, the benefits of physical exercise are numerous in the professional literature. As cited by Weyerer and Kupfer (1994), some of the results published in professional journals state that physical exercise can reduce the risk of coronary heart disease, fewer osteoporotic fractures, higher life expectancy, and higher rates of avoiding functional loss (Biddle & Fox, 1989; Paffenbarger et al., 1986; Pekkanen et al., 1987; Wagner et al., 1992).

Many professionals have studied the possibility of exercise having a benefit on mental health. Morgan (1974) stated that most physical education instructors have

adopted the position that a healthy body is a healthy mind, as cited in Folkins and Sime (1981). Professionals have researched specific hypotheses in regards to the relationship between exercise and mental health. “Improvements in cardiovascular functioning following training, for example, have been associated with reports of an increased sense of well-being (Buffone, 1980; Ismail & Trachtman, 1973) and with more effective management of emotional stress (Chapman & Mitchell, 1965)” as cited in Folkins and Sime (1981) p. 374. Stein and Belluzzi (1978) reported that the sense of well-being is an often cited phenomenon that follows exercise has been linked to the release of endorphins, which are morphine-like chemicals, produced in the pituitary gland of the brain, as cited in Folkins and Sime (1981). Lazarus (1975) stated that physical exercise is also thought to be a form of self-regulation and a means for a person to better cope with his/her environment, as cited in Folkins and Sime (1981).

Professionals imply that man is a psychophysical entity, meaning that the performance of the mind will alter the performance of the body, and vice versa, and that all human behavior is interrelated (Gupta, Sharma, & Jaspal, 1974). Duffy (1962) reported that if the exertion of energy is too low or too high, on either physical or mental activities, performance will suffer, as cited in Gupta et al. (1974). Duffy (1962) also reported that the optimal degree of activation seems to be moderate energy exertion, as cited in Gupta et al. (1974).

Ross and Hayes (1988) studied the effects of increased participation on psychological well-being and that the psychological well-being of both males and females improved due to the participation in physical exercise, as reported by



Weyerer and Kupfer (1994). Plante and Rodin (1990) reviewed the literature on exercise's effect on psychological health. The review found that exercise could improve mood and well-being, reduce anxiety, depression and stress. Exercise has also shown to have a positive improvement on self-concept, self-esteem, and self-assurance. The review also displayed no clear associations between physical fitness and type A behavior, locus of control, extraversion, and other personality dimensions, as cited by Weyerer and Kupfer (1994).

In a report by Comacho et al. (1991) on the relationship between physical exercise and depression among a large adult sample, the researchers reported that community mental health centers should seriously consider implementing a physical exercise activity into community programs to help prevent depression as cited in Weyerer and Kupfer (1994). Martin and Dubbert (1982) suggested that the beneficial effects of exercise in preventing heart and other disorders may, in fact, be due to psychological changes mediated from exercise, such as, decreased depression, anxiety, and improved self-concept as cited in Weyerer and Kupfer (1994).

Freemont and Craighead (1987) examined the effects of aerobic exercise and counseling for people suffering from depression. The results showed that aerobic exercise and counseling were individually and equally effective in improving depression, but aerobic exercise combined with the counseling was no more effective than either individual treatment, as cited by Weyerer and Kupfer (1994). Driscoll (1976) examined the effects of physical exercise on anxiety and found that the effect could be enhanced by the addition of psychotherapeutic methods, as cited in Weyerer and Kupfer (1994).

Bass (1985) reported on many professionals that have noted the psychological benefits of running as being; reduction in anxiety (Hollandaworth, 1979), reduction of depression (Greist et al., 1978), reduction in anger and aggression (Zentner, 1982), a euphoric high (Sacks & Sachs, 1981), an increase in extraversion (Herman, 1979), and an increase in self-esteem (Percy, Dziuban, & Martin, 1981). Bass (1985) reported on a review of literature discussing the physical benefits of running and found running activates a hormonal release (Lamb, 1978), and effects neuronal transmission (Colt, Wardlaw, & Frantz, 1981).

The following are possible explanations for the relationship between exercise and mental health presented by Plante and Rodin (1990), and taken from an article by Weyerer and Kupfer (1994).

#### Biological mechanisms:

- Body temperature increases due to physical exercise result in short term tranquility effects.
- Regular physical exercise facilitates stress adaptation due to an increase of adrenal activity, which increases steroid reserves which are available to counter stress.
- A reduction in resting muscle activity potential post physical exercise, causes tension release.
- Physical exercise enhances neurotransmission of noradrenaline (norepinephrine), serotonin (5-hydroxytryptamine; 5-HT), and dopamine, all of which result in improved mood.
- The psychological improvements resulting from physical exercise are due to the release of morphine-like chemicals produced in the pituitary gland of the brain.

### Psychological mechanisms:

- When improved physical fitness is achieved, it fills people with a sense of mastery, control, and self-sufficiency.
- Exercise is often thought of as a form of meditation triggering an altered and more relaxed state of mind.
- Exercise is a form of biofeedback teaching people to regulate their own autonomic arousal.
- Exercise provides distraction, diversion, or time away from unpleasant cognitions, behavior, and emotions.
- Social reinforcement amongst exercisers may lead to improved psychological states.
- Exercise may act as a buffer from such stressful life events, decreasing strain.
- Exercise competes with negative affects, such as anxiety and depression in somatic and cognitive realms.
- Exerciser brings on physical symptoms associated with anxiety and stress without the emotional distress. This repeated pairing of symptoms with no psychological stress leads to improved psychological functioning.

Exercise has long been thought of a possible treatment for children and adults with disabilities. Exercise has, at times, been the treatment of choice due to it being inexpensive, easy to implement, and the results are seen immediately.

### Mental Processes

Bills (1937) states that an improvement in physical fitness increases the oxygen transport capacity, as cited in Folkins and Sime (1981). “Bills found that increases in the oxygen content of inspired air following fatigue-inducing mental work led to recovery in mental performance” as cited in Folkins and Sime (1981) p. 376. Folkins and Sime (1981) summarize the effects of physical exercise on

improving cognitive mental functioning as being successful with geriatric mental patients, however, the results on normal adults and children is unclear.

Donoghue (1977) reviewed the literature on physical exercise and work behavior. The research states that physical exercise is associated with reduced absenteeism. Moreover, physical exercise breaks taken while on the job have also been associated with improved work output and a reduction in errors, as cited in Folkins and Sime (1981).

In a study by Gupta, Sharma, and Jaspal (1974), the results demonstrated that physical activity of 10 minutes or more reduced the performance of subjects on mental tasks. The increase in exercise time required more oxygen to be consumed by the body, thus, the lack of oxygen to the brain may have deteriorated the subjects performance on mental tasks. The researchers stated that the cerebral cortex has the highest metabolic rate in the central nervous system, and functions as the seat of higher level cognitive processes, and would most likely be most affected due to lack of oxygen.

Researchers have also looked at the effects of exercise on mental cognition. Young (1978) found physical activity correlated with improvement on test scores of intelligence, brain function, speed of performance, memory, and learning, as reported by Bass (1985). Elsom (1981) demonstrated that jogging improved the visual and auditory attention span of as well as decreasing the hyperactivity of hyperactive young men, as reported by Bass (1985).

The effects of physical fitness and sleep have been researched by Folkins, Lynch, and Gardner (1972), with results stating that college females who showed

improvements in aerobic activity also reported improvements in their sleep behavior, as cited in Folkins and Sime (1981).

The most avid exercisers report an overall improved sense of well-being (Folkins & Sime, 1981). The relationship between improved well-being and physical exercise has been corroborated by many professionals (Carter, 1977; Husman, 1978; Snyder & Spreitzer, 1974;), as cited in Folkins and Sime (1981). Past professional literature stated that self-concept could be enhanced by increasing the amount of physical exercise, which alters a persons body image, which may radiate to self-concept (Zion, 1965) and affect (Goldberg & Folkins, 1974) as cited in Folkins and Sime (1981). However, a review of literature by Layman (1974) on self-concept and physical exercise found that while four out of seven studies involving tests of self-concept before and after a physical development program reported an improvement in self-concept, three reported no change as reported by Folkins and Sime (1981). A researcher's note must be made here. Many of the participants in studies emphasizing physical fitness and an improved sense of well-being are actively seeking just such an improvement. Selection bias is a tremendous problem, due to the fact that subjects of such studies are receiving so much attention could be the reason for their improved sense of well-being (Folkins & Sime, 1981). The evidence to support a connection between changes in personality and physical fitness training is still inconclusive.

### Other Processes

The effects of physical activity within the population of people with disabilities have been represented in many ways. The body image of children with mental retardation improved to positive after participating in physical development

programs (Chasey, Swartz, & Chasey, 1974; Maloney, Ball, & Edgar, 1970), as cited in Folkins and Sime (1981). Studies by B.J. Brown (1977) and Numley (1965) report that exercise programs for children with disabilities have also shown to be important in the development of social skills, as cited in Folkins and Sime (1981).

Pitetti, Rimmer, and Fernhall (1993) report on the research of several professionals that have come to the conclusion that a disproportionate number of people diagnosed with a mental disability are also classified as obese (Burkhart et al., 1985; Eichstaedt & Lavay, 1992; Jackson & Thorbecke, 1982; Staugaitis, 1978). There are many factors that may come into play for the increased obesity in the population diagnosed with mental disabilities. Fait and Dunn (1984) reported that medication may place the individual in such a relaxed and medicated state that the individual lacks the energy to complete a regular physical development program of any kind, as reported by Pitetti, Rimmer, and Fernhall (1993). Motivation may also be a factor effecting the completion of a physical development program due to low cognitive levels (Fait & Dunn, 1984), as reported by Pitetti et al. (1993).

### Exercise and Disabilities

#### Mental Retardation

Day and Day (1977) reported on research which stated that those diagnosed with mental retardation may benefit from the effects of a structured physical program due to the fact that many are not self-directed enough, many have an abundance of time as a result of shortened work and school days, and those with mental retardation have the right to participate in programs the same as other non-disabled peers, as

reported by Moon and Renzaglia (1982). Stereotypic behavior can also be problematic as Jansmana and Combs (1987) review:

Stereotypic behavior among persons who are mentally retarded may also be subnamed under the heading of antisocial behavior. Excessive body rocking, rapid movements of the hands/fingers/arms, rapid head movements, and self-injurious behaviors are some typical, inappropriate self-stimulatory behaviors...In addition, individuals with stereotypic behavior interact less with their environment, therefore, it is important that persons who are retarded be provided with intervention that lessens the likelihood of this behavior (Berkson, 1964; Berkson & Mason, 1964; Koegel & Covert, 1972). (cited by Jansma & Combs, 1987, pp. 268-269)

Researchers Pego and Clementally (1979) and Wheman (1979b) have stated that physical programs for the more severe and profoundly mentally retarded may be even more beneficial because exercise builds basic skills such as ambulation and fine-motor control as reported by Moon and Renzaglia (1982).

Moon and Renzaglia (1982) report that physical fitness may promote cognitive and affective variables such as IQ, academic performance, self-concept, and social interaction skills in the mentally retarded. However, Campbell (1973) reports that replication of studies demonstrating these phenomenon have failed, with no empirical cause and effect relationship having been shown as reported by Moon and Renzaglia (1982).

Professionals have demonstrated repeatedly that the fitness level of individuals diagnosed with mental retardation is inferior to that of non-disabled peers (Campbell, 1973), with the more severe the diagnosis of mental retardation is the more significantly less fit persons are compared to non-disabled peers (Howe, 1959; Londeree and Johnson, 1974), as cited in Moon and Renzaglia (1982). One of the first researchers to demonstrate those diagnosed with mental retardation are less fit

than their non-disabled peers was Howe (1958), as reported by Moon and Renzaglia (1982). Howe (1958) demonstrated that educable mentally retarded (EMR) children were significantly poorer on 11 motor tasks when compared to non-disabled peers as cited in Moon and Renzaglia (1982). Maksud and Hamilton (1974) reported that the maximal oxygen uptake of EMR children and adolescents was lower in comparison to that of non-disabled peers, as reported by Moon and Renzaglia (1982).

Researchers have been plagued with difficulties in trying to develop instructional methods for a physical fitness program for those diagnosed with mental retardation. The main problem has been the lack of maintaining the program after the initial use (Moon & Renzaglia, 1982). Researchers have noted that a possible way in which to maintain the physical fitness program may be to initiate a token system, start an exercise club, or peer reinforcement.

Jansma and Combs (1987) reported on the effects of their study involving five males displaying maladaptive behaviors with a dual diagnosis of mental retardation and emotionally disturbed, placed through a fitness training/reinforcement program. The researchers observed for one hour after physical training to note the effects physical training had on the maladaptive behaviors of the five males. Baseline data were gathered for one week prior to the fitness training. The results of the study showed that reinforcement based physical fitness training had a significant effect on the maladaptive behaviors of the five males. Maladaptive behavior decreased during the intervention phase and increased during the baseline phase. Data demonstrated a relationship between the independent variable (fitness training) and the dependent



variable (maladaptive behaviors) in an ABAB research design (Jansma & Combs, 1987).

Bruininks (1974), reported that children diagnosed with mental retardation involved in a structured physical fitness program which includes gross-motor skills with simple tasks, allows for successful participation in physical fitness programs, as cited by Beasley (1982). Other researchers reported that children diagnosed with mental retardation fall below peers not diagnosed with mental retardation on physical fitness tests (Henderson, Morris, & Ray, 1981; Howe, 1959; Malpass, 1960; Rarick et al., 1970; Widdop, 1968), as cited by Beasley (1982). However, when appropriate fitness training was provided, subject's progress, although slower, was equal to that of peers not diagnosed with mental retardation (Chasey, 1970; Solomon & Pangle, 1967), as reported by Beasley (1982).

A study by Beasley (1982) looked at the effects of jogging on the work performance of mentally retarded adults. Results demonstrated that jogging for 30 minutes per day, five days a week, was effective in increasing work performance on piece-goods production, as well as cardiovascular fitness.

A study by Bachman and Fuqua (1983) looked at the effects exercise had on four trainable mentally impaired (TMI) students. The study involved a baseline measurement and Phase I, II, III, IV, V, which were different levels of jogging. Phase I consisted of two alternating conditions; warm-up exercises and short distance jogging to produce a moderate heart rate (.98 miles). Phase II consisted of two alternating conditions; no exercise and vigorous heart rate jogging (1.47 miles). Phase III consisted of jogging on consecutive days the same distance as was specified

in Phase 2. Phase IV consisted of student two jogging as at vigorous rate for 1.96 miles. Phase V consisted of student two completing no exercise. Moderate and vigorous heart rates were determined by a formula (Fixx, 1977; Vitale, 1973) to calculate pulse rates for each student that would produce similar training effects across individuals regardless of their age or state of physical condition, as cited in Bachman and Fuqua (1983). Results of the study showed that for three of the four students, when exercise was present it reduced the inappropriate behaviors, even when alternated with warm-up only and no exercise days. “The degree of behavior change associated with jogging was modest for all students, and other behavior management procedures (e.g., time-out, punishment, over correction, DRO) have produced equivalent or larger decreases in inappropriate behavior” (Bachman & Fuqua, 1983 p. 482).

### Behavioral Disorders

In a study by McGimsey and Favell (1988), six participants (3 male and 3 female) displaying severe behavior problems were conducted through a multiple baseline study involving exercise as the treatment (experiment 1). The treatment, or exercise phase was 30 minutes of access to an outside recreational area. Results of the study showed that for four of the six participants in the study exercise was an effective deterrent for aggression and hyperactivity.

Professionals have looked at the effects of jogging on the classroom behaviors of behaviorally disordered children. Allen (1980), Anderson (1985), Bass (1985), and Evans, Evans, Schmid, and Pennypacker (1985) have looked extensively at the

effects jogging has had on the classroom behaviors of behaviorally disordered children, reporting positive results, as cited by Yell (1988).

In a study by Yell (1988), the effects of jogging on the classroom behavior of six behaviorally disordered children was looked at. An ABAB design was used to assess the effects. The A phase consisted of school work (math assignments), and the B phase consisted of jogging for 30 minutes. Results of the study demonstrated that jogging decreased the behaviors of five of the six participants in the study. The use of the ABAB research design showed that it is highly likely that jogging, and not any other extraneous variables, were the reason for the decreased behaviors. The decrease in behaviors from jogging may act as an alleviation from stress and anxiety (Higdon, 1978), and hostility (Winnick, 1979), as reported by Yell (1988). Yell (1988) reported that jogging was shown to have an effect on the behaviors of five of the six participants. Yell (1988) believed that allowing or scheduling time in the day for children diagnosed with behavior disorders to exercise may be a worthwhile venture if it leads to positive effects on behaviors.

Allen's (1980) study adds to the professional literature with the results of the study reported a decrease in disruptive behavior of learning disabled children as jogging increased from 5-10 minutes.

### Autism

Exercise has been a researched treatment for the alleviation of the symptoms of autism for some time. For persons with autism, professionals have shown significant decreases in stereotypic responding after physical activity. Specifically, exercise has been used as a treatment for the alleviation of self-stimulating behaviors

of those diagnosed with autism. It is strongly urged by professionals that a systematically developed physical fitness regimen be developed for children with autism and other disabilities (Jansma & Combs, 1987).

Professional literature had repeatedly found a correlation between inactivity and aberrant behavior (Beisser, 1970; Dodson & Mullens, 1969; Nunley, 1965; Paxton, 1970), suggesting maladaptive behaviors may be able to be reduced by exercise, in which case, children can then be moved to less restrictive environments, as reported by Elliott et al. (1994).

Persons with autism are often characterized by their self-stimulatory behavior such as body rocking, spinning, hand flapping, head-nodding, object-tapping, gazing at lights, and mouthing (Lovaas, Newsom, & Hickman, 1987; Sugai & White, 1986). Research literature has shown that these general behaviors interfere with both the performance of positive social behaviors and learning (Bass, 1985; Kern, Koegel, Dyer, Blew, & Fenton, 1982; Sugai & White, 1986). (cited in Rosenthal-Malek & Mitchell, 1997, pp. 193)

Wilhelmina Waters (1980, co-author), a professional specializing in the instruction of autistic children, noted that self-stimulating behaviors decreased following periods of gym, field trips, and outside excursions. Watters and Waters (1980) studied five male subjects diagnosed with autism in various settings. The first precondition consisted of academic periods typical of an academic day. The second precondition consisted of TV watching. The third precondition consisted of exercise which involved jogging in the schoolyard for 8-10 minutes. Following placement in a precondition, subjects then participated in a group language training session. Results demonstrated that there was a decrease in self-stimulating behaviors following the exercise precondition compared to the academic precondition and the TV watching

precondition. The average decrease in self-stimulating behavior of 32.7% was determined to be significant by teachers.

A study by Kern et al., (1982) looked at the increased physical activity as a possible method to decrease self-stimulating behavior and increase appropriate responding in seven children diagnosed with autism. Results demonstrated that self-stimulating behaviors decreased and appropriate play as well as academic responding increased after jogging.

A study by Chock and Glahn (1983) looked at the relationship between self-stimulating and behavior and learning in six children diagnosed with autism. Subjects fit into two, three subject groupings of mute low-functioning or echolalic higher functioning. Subjects were observed in a baseline condition, a task condition with no suppression, and a task condition with suppression. In the task with suppression, subjects were reinforced for correctly responding to the task with verbal praise, food, and /or beverages. Results suggested that suppressing the self-stimulating behaviors of all children diagnosed with autism is not necessary for them to learn. Higher functioning children did not need their self-stimulating behaviors suppressed to make them able to respond correctly, however, lower functioning children did need their self-stimulating behaviors suppressed in order for them to meet criterion on a learning task.

Kern, Koegel, and Dunlap (1984) studied the effects of a vigorous and continuous (jogging) versus a much less vigorous (ball playing) exercise on the self-stimulating behaviors of the three children diagnosed with autism. Baseline was taken every day (60 minutes of observation) before researchers administered the

exercise. Conditions were 15 minutes in length and were alternated each day. The day started with baseline observation for 60 minutes, followed by a condition (jogging or ball play), after which there was a 90 minute observation of the child. Then the child was placed in the alternate condition from which it started (jogging or ball play), followed by a 90-minute of observation. And finally, a return to the initial condition, followed by a 90-minute observation. Results of the study demonstrated that the effects of jogging decreased self-stimulating behavior of the children diagnosed with autism, these results are consistent with previous professional literature. Results also demonstrated that the less vigorous exercise condition produced no significant decreases in self-stimulating behavior.

Baumeister and MacLean (1984) reported that antecedent conditions may be a way in which those that do not have, or need to receive, specialized, excessive, expertise training in contingencies can still carry out the ability to alter undesirable or inappropriate behaviors, as reported by Elliott et al. (1994). Bachman and Fuqua (1983) reported that antecedent conditions do not demand the person to immediately detect and consequate specific behaviors, as reported by Elliott et al. (1994).

Elliott et al. (1994) studied the effects exercise had on the maladaptive behaviors of adults diagnosed with autism and mental retardation. Three men and three women participated in the study, all from a residential treatment program for people with autism. Participants had their resting heart rates measured, and then were taken into the control room individually and their stereotypical behaviors were recorded. Participants then engaged in one of three conditions for 20 minutes. A no exercise room was used for control purposes, with the other two conditions being

general motor training and vigorous aerobic exercise. General motor training activities were defined as raising the heart rate between 90 and 120 beats per minute by riding an exercise bike. The vigorous aerobic activities were defined as raising the heart rate above 130 beats per minute by jogging on a treadmill at 4.0 miles an hour. Heart rates were immediately assessed post condition completion, with participants then placed in the control condition and observed for the target stereotypic behaviors for 30 minutes. This routine was followed until each participant had completed five sessions in each of the three conditions. Results of the study showed that antecedent vigorous aerobic exercise decreased the amount of stereotypical behaviors in the control setting, while the general motor training activities did not. Such a result would give rise to the correlation between the vigorousness of exercise in reducing the stereotypical behaviors of those with autism.

Professionals have done much research in the area of aerobic exercise and its effects on decreasing negative behaviors. Research on the autistic population in the realm of aerobic exercise and its effects on stereotypical behavior have yielded results that show exercise has been shown to reduce self-stimulating behavior without decreasing academic levels and increasing appropriate responding (Elliott et al., 1994; Kern et al., 1984; Powers et al., 1992; Watters and Watters, 1980), as cited in Rosenthal-Malek and Mitchell (1997).

In a study by Rosenthal-Malek and Mitchell (1997), five adolescent males diagnosed with autism participated in a study that looked at the effects of aerobic exercise on self-stimulating behaviors. The study had two preconditions, an aerobic exercise precondition and an academic precondition. The aerobic precondition

consisted of 20 minutes of jogging. The academic precondition consisted of teacher-directed lessons on coin values. All five participants participated in the two groups together. After completion of the preconditions, the participants were taken to either the regular classroom or the community-based workshop. Results of the study indicated that there was a significant decrease in self-stimulating behavior following the exercise precondition as compared to the academic precondition. A further result of the study showed correct responding increased following the exercise precondition as compared to the academic precondition, and that the number of tasks increased following the exercise precondition as compared to the academic precondition.

The results of the Rosenthal-Malek and Mitchell (1997) study confirm the results found by Watters and Watters (1980), Kern et al., (1984), Powers et al., (1992), and Elliott et al., (1994), as well as expanded the results to the adolescent population. A further result of the study demonstrated that aerobic activity decreased self-stimulating behaviors while not decreasing other positive behaviors. Rosenthal-Malek and Mitchell (1997) report that the issue of time and intensity of aerobic activity need further research to come to an exact answer. Professionals in the past have used varying times and intensity levels and that is why the issue of time and intensity level are still under consideration.

The long-term effects of aerobic activity on the self-stimulating behaviors of those diagnosed with autism have only been addressed by a handful of professionals. Gabler-Halle et al., (1993) reported that the greatest degree of change was seen immediately following exercise as reported Rosenthal-Malek and Mitchell (1997). Jansma and Combs (1987) reported that within two weeks of completing the exercise



program, maladaptive behaviors returned to their original levels, as reported by Rosenthal-Malek and Mitchell (1997).

Koegel and Covert (1972) reported that children diagnosed with autism are unresponsive to their environment when engaged in self-stimulating behavior. Their research focused on several questions. Do children diagnosed with autism fail to acquire discriminations when engaged in self-stimulating behavior? When the suppression of self-stimulating behavior is accomplished, are discriminations facilitated? Three subjects diagnosed with autism, were mute, and expressed high-frequency self-stimulating behavior participated in the study. Subjects were trained to respond to a stimulus and to not respond when the stimulus was not presented. Results of the study showed that the children did not acquire the discrimination when they were engaged in the self-stimulating behavior. However, when the self-stimulating behaviors were suppressed, the discrimination was acquired and the discrimination was associated with a reduction in self-stimulating behavior, regardless of the use of aversive stimuli to suppress the behaviors. The study did use aversives such as yelling “No!” to the children or slapping them on the hand when they responded incorrectly. The authors of the study concluded by saying that if one is to teach a task or new behavior to a child diagnosed with autism, it is important to ensure that the child does not engage in self-stimulating behavior.

Levinson and Reid (1993) addressed the factors of duration and intensity concerning the effects of physical activity on self-stimulating behaviors. The concept proposed that stereotypic behaviors are maintained by resulting feedback (Berkson, 1983; Lovaas et al., 1987), as cited in Levinson and Reid (1993). According to

Berkson (1983) to maintain the sensory input a behavior must be repetitive, thus a rhythmic pattern is the most efficient manner in which to maintain the behavior. Hence the rhythmic and repetitive nature of stereotypes seen in the behavior of those diagnosed with autism, as reported by Levinson and Reid (1993).

The study by Levinson and Reid (1993) involved three subjects, two male and one female, all diagnosed with autism. Participants were placed in a mild and a vigorous exercise treatment condition. The mild exercise condition consisted of 15 minutes of walking. The vigorous exercise condition consisted of 15 minutes of jogging. A baseline was taken in the classroom recording stereotypical behaviors, as well as a pre and post exercise count of stereotypical behavior. The study consisted of three phases and lasted nine weeks. Phase one was the establishment of baseline, where all participants were observed in the classroom. Phase two consisted of administering the treatment conditions in a counterbalanced, systematic fashion. Phase three was another observational phase such as the one in phase one. The stereotypical behaviors of the students were observed 45 minutes prior to the exercise condition each day. This was in order to establish the frequency of the stereotypical behavior for that particular day. Following the exercise condition, subjects were observed for another 45 minutes for the occurrence and frequency of stereotypical behavior. The authors of the study differentiated between the stereotypic behaviors to determine if the type of exercise program had an effect on the type of behavior classified as motor, vocal/oral, or other. Results of the study demonstrated that the vigorous exercise condition was the most effective in reducing stereotypic behaviors

immediately after the exercise condition. Effects of the vigorous exercise treatment on stereotypic behaviors was no longer apparent after 1 \_ hours after administration.

Results of the study support Berkson's (1983) hypothesis of self-stimulating behavior and sensory feedback. The data from the current study have shown that "the overall reduction in stereotypic behaviors occurred primarily as a function of a decrease in the motor component, when the alternative activity was of sufficient intensity," as cited in Levinson and Reid (1993) p. 266. The study addressed the issues of intensity and mode of exercise, stating that the mode of exercise should mimic the sensory feedback the person receives from the stereotypic behaviors expressed by the person.

### Summary

An underlying notion present in the literature is that humans are motivated by the interaction between psychological processes and physical reactions. Humans are not purely physical beings, nor are they purely psychological beings. Previous professional literature stated that the effects of aerobic activity cross the boundaries of sex, age, and ability to show benefits. Previous professional literature stated that benefits from aerobic activity are evident in disorders such as mental retardation, autism, behavior disorders, depression, and anxiety. Aerobic activity has also been linked to other psychological processes relating to self-concept and relaxation. Outside of the realm of psychological benefit is the ever-present physical benefit from aerobic activity. Professionals have reported time and time again of the critical physical benefits from maintained aerobic activity. Professionals stated that the physical benefits one receives from maintained aerobic activity affect the

psychological process of the persons, which in turn affect the physical well being of the individual. Professionals reported a cyclical reaction of physical and psychological enhancement could be achieved by maintained aerobic activity.

Previous professional literature reiterates time and time again that children diagnosed with autism may benefit from aerobic activity in reducing self-stimulating behaviors. The implications of such studies add to the present research available on alleviating some of the symptoms of individuals diagnosed with autism. Professional literature reviewed for this paper have shown a variety of aerobic activities used in achieving beneficial results in reducing self-stimulating behaviors of children diagnosed with autism.

Many of the research studies reviewed used children diagnosed with autism which displayed motor self-stimulation. A further research need may be that children displaying vocal or verbal self-stimulating behaviors be observed for the effects of aerobic activity on reducing the vocal or verbal self-stimulating behaviors.

## CHAPTER 3

### METHODOLOGY

The following information is a description of the participants of the study and an explanation of the self-stimulating behaviors of each individual child, the qualifications of the student's teachers, and the settings in which the research study took place. Information is provided discussing the ABA research design and the conditions of each phase of the study. A detailed description of the procedures has been provided as well as a detailed description of each phase of the study including baseline and treatment.

#### Participants

##### Permissions

The Human Subjects Review Board at the University of Northern Iowa and the local Area Education Agency had both given permission for the researcher to conduct the study. The local Area Education Agency granted permission for the researcher to conduct the study in a specific school in the community. The researcher had the permission of the school principal and the school psychologist assigned to the school to conduct the research. The researcher also obtained written permission from all participants, teachers, and parents.

##### Teacher Qualifications

The personnel in the classroom consisted of the head teacher and paraprofessionals that assist in the classroom. The children came from different classrooms and therefore had different teachers. Other persons involved in the study were the physical education instructors.

Subject one's classroom teacher attained her B.A. in special education in moderate, severe, and profound mental disabilities, has had structured teaching, TEACCH (Treatment and Education of Autistic and related Communication Handicapped Children) and DTT (Discrete Trial Training) training, and has had eight years of experience teaching at the school averaging 2-3 children diagnosed with autism each year.

Subject's two's classroom teacher attained her B.A in secondary social science and another B.A. in elementary education with a remedial reading endorsement, holds a Master's degree in severe and profound mental disabilities, taught at a community agency that provides services for those with disabilities, and has attended many conferences on autism.

Subject three's classroom teacher attained her Master's degree in moderate, severe, and profound disabilities, has had TEACCH training, and has had eight years of teaching experience at the school.

Two Physical Education instructors were on site at the school. One Physical Education instructor obtained her B.A. in physical education with an emphasis of adaptive physical education, has attended state hospital week long training on the TEACCH program, and is a client and staff safety trainer for the local AEA.

The other Physical Education instructor obtained his B.S. in adapted physical education, has taught at the school for 24 years, is currently working towards a Masters in Special Education, and has attended state hospital week long training on the TEACCH program.

### Teacher Consultation in Regards to Subjects

The researcher discussed with each individual classroom teacher issues concerning each individual child. The first issue discussed with each individual head teacher was an activity the teacher thought the child would engage in that would be aerobic by definition of heart rate by the American College of Sports Medicine (1990) as cited by Lochbaum and Crews (1995). The researcher considered all suggestions for activities to elevate the subject's heart rates to an aerobic level but was not limited to the activity suggested by the head teachers.

A second issue discussed with each individual head teacher is what task the child would be completing after transitioning back into the classroom. The task had to be one that the child had previous experience with, experienced previous success with, and can be completed during a regularly scheduled class time.

A final issue the researcher discussed with each individual head teacher was what each individual child would like as a preferred item should the child have a difficult day and refuse to participate or display violent behaviors towards caretakers or self. The preferred item was not used to motivate the subjects to complete a condition requirement (non-aerobic or aerobic) or an activity in the classroom when the subjects were observed, but used only to calm the subject if the subject had a difficult day.

The teacher for Subject one (S1) reported that S1 would most likely engage in the aerobic activities of walking on a treadmill, roller skating, or bouncing on a mini trampoline. The teacher for S1 stated tasks S1 could do in the classroom while the researcher recorded the specific dominant behavior could be putting a puzzle together

or placing items on a pegboard (many activities S1 completed were matching or arranging objects to match that of a picture). The teacher for S1 also stated that appropriate preferred items would be playtime with a substance called Gooze, a cheese cracker, or a weighted blanket.

The teacher for Subject two (S2) reported that S2 would most likely engage in the aerobic activities of walking or riding a bike. The teacher for S2 stated a task S2 could do in the classroom while the researcher recorded the specific dominant behavior could be picking-up and placing blocks into a bin (many activities S2 completed were fine motor activities such as placing objects in a bucket). The teacher for S2 also stated that appropriate preferred items would be play time with a mirror, play time with bells, looking out the window, looking at cars and trucks in the parking lot, or play time with his favorite purple glass.

The teacher for Subject three (S3) reported that S3 would most likely engage in the aerobic activities of walking, or completing a segment of a low impact aerobic video. The teacher for S3 stated tasks S3 could do in the classroom while the researcher recorded the specific dominant behavior could be sorting items, matching items, or counting items using a jig (many activities S3 completed were matching items to items on a pegboard and counting). The teacher for S3 also stated that appropriate preferred items would be food or a desired activity in the classroom.

### Subjects

Subjects participating in the study had a previous diagnosis of autism and were also diagnosed with severe or profound mental retardation. All subjects displayed self-stimulating behaviors at a high frequency as reported by teachers.



Subjects all attended the same school designed to assist students with severe and profound disabilities, such as autism.

A total of three children actively participated in the study from a possible group of five. Two subjects that were not used in the study had not returned the permission slip granting their participation in the study. No names were used to report the characteristics of the children, and all were assigned a number and were referred to as Subject one (S1), Subject two (S2), or Subject three (S3) as appropriate throughout the research report.

Subject one was a male, age 9, non-verbal, who communicated with the use of a PECS (Picture Exchange Communication System), and a picture schedule to help transition him through the activities of the school day and better help him communicate his wants and needs. The subject's self-stimulating behaviors were object manipulation, he flicks fingers, squealed a very high pitched squeal, sought out pressure on his body, placed items in his mouth, and was in constant movement.

Subject two was a male, age 10, non-verbal, who communicated through the use of an object schedule (he was still being trained to use) to help transition him through the activities of the day and better help him communicate his wants and needs. The subject's self-stimulating behaviors were rocking, object manipulation, he placed his finger on his eyelid, he made vocal noises (moans and high pitched squeals), and was in constant movement.

Subject three was a female, age 17, non-verbal, who communicated through the use of a picture schedule and key sign language signs to transition her through the activities of the day and to better help her communicate her wants and needs. Subject

three was very prompt driven to complete tasks she assigned to her throughout the day. The subject's self-stimulating behaviors were distraction with her hands, she stared at her hands and moved them up and down while keeping her hands flat, she stared off into space as if she heard something, and twitched her neck.

### Setting

The setting was a midwestern metropolitan area with roughly 175,000 inhabitants. Within the area was a mid-sized university which provided the facility with many college students trying to fulfill obligations of classroom requirements such as doing field experiences as part of professional preparation programs in health, education, and recreation.

The school was a self-contained public school serving students with moderate, severe, and profound disabilities. The school served roughly 160 students from the ages of birth to 21 years of age. The school was funded by a regional area education agency. Curriculum in the school focused on independent living skills and vocational training skills.

### Classroom Setting

The research utilized two rooms for the study. The first room was the gymnasium. The second room was a self-contained special education classroom. Weather permitting, the subjects had the option of going outside to use the jungle gym, swings, or walk or ride a bike around the perimeter of the school building on a paved walkway. The other children in the rooms were all diagnosed as having a moderate, severe or profound disorder. Each class had approximately five-seven students in it with a lead teacher and up to three assistants based on the severity of the

disorders students were diagnosed with and the need for extra assistance in the classroom at any given time.

### Researcher and the Researcher's Role

The primary researcher for this study was a graduate student fulfilling the requirements for the degree of Specialist in Education in School Psychology. The researcher had a Bachelor's degree in Psychology and a Master Arts in Education degree. The researcher had eight years of experience in working with both adults and children with autism and other disabilities through community agencies and organizations. The researcher had also completed a Master's paper entitled Social and Communication Process in Autism: Etiology and Treatment.

### Researcher as Instructor

The researcher was directly involved in communicating the instructions to all three of the subjects. The researcher's role throughout the study was to participate in the aerobic activity with the students, modeling the desired behavior. The researcher instructed the subjects what to do in all conditions of the study and when the subjects were transitioned back to the classroom. Directions were given both in verbal form and by use of the subjects communication devise (picture or object schedules).

### Researcher as Observer

The researcher served as the primary observer for the study and collected all the data for the study. The researcher transitioned all subjects back to the regular classroom and then observed for the dominant behavior displayed by the subjects in 90 ten-second intervals (15 minutes total).

### Research Design

The research design used was an individualized treatment and baseline procedure known as an ABA single subject design. The non-treatment portion of the study (A) referred to the time when subjects were involved in a non-aerobic activity, then transitioned back to the regular classroom and observed for the expression of the dominant behavior. The treatment portion of the study (B) referred to the time when subjects were involved in an aerobic activity for 20 minutes. The aerobic activity for each subject was not predetermined and was defined as any activity that would consistently elevate and maintain the heart rate at an aerobic level for the 20 minutes needed for the aerobic Condition as defined by the American College of Sports Medicine (1990), as cited in Lochbaum and Crews (1995). Following the treatment portion of the study, subjects were transitioned back to the regular classroom and observed for the expression of the dominant behavior.

### Heart Rate

For a subject to be considered to be in the aerobic state, the American College of Sports Medicine (ACSM, 1990) recommends achieving 60-90% heart rate maximum (considered to be moderate) as an appropriate intensity to maintain cardiorespiratory fitness based on 20 minutes of exercise in one session, as reported by Lochbaum and Crews (1995). To calculate the appropriate heart rate range considered to be non-aerobic and aerobic, the HRmax (maximum heart rate) formula was used. The calculation was:

$$[220 - \text{Age}] * \text{Percentage Range} = \text{Heart Rate Range}$$

The following were the calculated heart rates for the three subjects used in the current study.

S1-age 9       $[220-9] * .60 = 127$  (bottom limit)

$[220-9] * .90 = 190$  (upper limit)

S2-age 10       $[220-10] * .60 = 126$  (bottom limit)

$[220-10] * .90 = 189$  (upper limit)

S3-age 17       $[220-17] * .60 = 122$  (bottom limit)

$[220-17] * .90 = 183$  (upper limit)

### Research Variables

The dependent variable in the study was the specific dominant behavior expressed by the subjects every ten seconds, for a total of 90, ten-second intervals during a 15-minute observation in the regular classroom immediately following a non-aerobic and aerobic activity. Data collection consisted of choosing the dominant behavior expressed by the subject's from a data sheet containing specific behaviors for each ten-second interval for a total of 90, ten-second intervals (15 minutes) during the observation time following a non-aerobic and aerobic Condition. A behavior was considered dominant when the subject's demonstrated it for 60% of the time or greater (six seconds or longer) during each ten-second interval. The four specific behaviors the researcher had to choose from were: Self-stimulating/engaged (SSE), not self-stimulating/engaged (NSSE), self-stimulating/not engaged (SSNE), not self-stimulating/not engaged (NSSNE). Self-stimulating behaviors were defined for each

individual subject earlier and were used to determine whether subjects were self-stimulating or not. Engagement was defined as the subject's physically working on the task, with focused attention on the task and not on other activities other students were working on in the regular classroom following the non-aerobic or aerobic Condition. The independent variable in the study was the presence or absence of an aerobic activity.

### Procedures

#### Length of the Study

The study started on March 26<sup>th</sup>, 2002 and ended on April 24<sup>th</sup>, 2002. The time frame allowed the study a full five weeks without interruptions due to regularly scheduled breaks in the school year. The study was conducted around regularly scheduled times and events. The researcher did not have dominant control over subject's schedules, suggesting the research had to be conducted at times that fit into the subject's schedules and the researcher's schedule.

Subjects were conducted through the study moving from Condition A (non-aerobic activity) to Condition B (aerobic activity) and a return to Condition A (non-aerobic). The researcher recorded the dominant behavior individual subjects displayed during each ten-second interval) for a total of 90, ten-second intervals) during a 15-minute observation immediately following Condition A, Condition B, and Condition A again.

### Identification of Self-Stimulating Behaviors

Teachers were asked to identify the self-stimulating behaviors of each individual child. Teachers were asked to be very specific (including imitating the behavior) when they reported each individual subject's self-stimulating behaviors. Information was gathered on the age, sex, social and communication capabilities of each individual child (echolalic, non-verbal, verbal-what words, sign language-which signs), and the specific self-stimulating behaviors of each individual child.

### Heart Rate Monitor

The subject's heart rate was taken using a hand held heart rate monitor (Biosig Instrument 105 (BSI-105)). The Biosig Instrument is a hand held, baton shaped, heart rate monitor that provides a heart rate when grasped by both hands. The subjects gripped the instrument at two contact points and held for five seconds. The heart rate instrument sensed the electrical activity of the heart and computes the heart rate from the electrical activity.

The heart monitor was used to measure the subject's heart rate at five-minute intervals during the 20-minute non-aerobic and aerobic Conditions. The researcher demonstrated how to hold the instrument, and verbally explained to the subjects what they had to do. The researcher obtained the subjects attention by saying, "look at me" and pointed to the researcher's eyes. The researcher then placed the subject's hands on the heart rate instrument at the appropriate contact points and counted the time out loud the child had to hold on to the instrument. The researcher then gave the subject positive verbal feedback when the child successfully completed the heart rate

measurement. Verbal redirections were given to subjects when subjects did not follow the directions for measuring heart rate, followed by another demonstration by the researcher as to the appropriate way to measure heart rate.

### Switch Points

The researcher determined switch points for the subjects in the study. A switch point was a point in the study when a subject has had four consecutive research days of aerobic or non-aerobic activity and was then switched to either an aerobic or non-aerobic activity opposite. The study had to be run on the days of Tuesday, Wednesday, and Thursday due to a time factor the researcher had. Thus, a research day was a Tuesday, Wednesday, or a Thursday. For example, a subject's individual heart rate data revealed that for four research days the subject had been non-aerobic, and the specific dominant behavior displayed by the subjects was recorded every ten seconds for a total of 90, ten-second intervals (15 minutes) in the classroom on Tuesday, Wednesday, Thursday and Tuesday. Following with the example, on the next research day (Wednesday) the subject would be switched to an aerobic activity Condition and the specific dominant behavior displayed by the subject would be recorded every ten seconds for a total of 90, ten-second intervals (15 minutes) in the classroom. The subject must have four consecutive research days of an aerobic activity Condition before switching back to a non-aerobic activity Condition.



### Condition A (Non-Aerobic Activity)

Baseline was established the first four consecutive research days the researcher worked with the subject's individually. The researcher simply observed and recorded the frequency of the dominant behavior the subjects engaged in while in the regular classroom setting completing a task they have had success with in the past following the A Condition. The researcher personally conducted the baseline observations.

During Condition A of the study, subjects were individually transitioned to the gymnasium by the researcher via the use of the subject's individual communication system. The researcher completed each individual baseline (20 minutes of a non-aerobic activity) with each subject individually.

During Condition A the subject's heart rates were measured and recorded every five minutes, for a total of four times during the 20 minute non-aerobic activity. An activity was considered to be non-aerobic when subject's heart rates remained below the bottom limit of the individually calculated aerobic heart rate. The subject had to do an activity in the gym, and it had to be a non-aerobic activity. Examples of physical activities a child could do and not reach an aerobic heart rate are to play catch with a ball, walk laps, or shoot baskets. Specific activities were not pre-planned ahead of time due to the fact that the subjects might not have wanted to participate in the pre-planned non-aerobic activity. Subjects were considered to be in a non-aerobic state if the heart monitor reading for each subject was at or below the subject's

individually calculated non-aerobic heart rate for three out of four times the heart rate was taken and recorded.

Following the non-aerobic activity, subjects were transitioned back to the classroom via their individualized communication system, accompanied by the researcher. Once in the classroom, the researcher immediately observed for and recorded the specific dominant behavior expressed by the subjects during each ten-second interval for a total of 90, ten-second intervals (15-minutes) while subjects worked on a selected in a task. The task subjects worked on immediately after the non-aerobic activity could be completed by the child in 10-20 minutes and was one the child had completed before and known success with so as not to cause any specific behaviors due to the introduction of a novel task, and to make it as natural as could be for the subject.

Each subject was individually conducted through an individualized non-aerobic activity, and each subject's individual heart rate was recorded. After a subject had four consecutive research days of three or more non-aerobic heart rate level recordings and each of the research days had data on 90, ten second intervals containing the specific dominant behavior expressed by the subjects immediately after the non-aerobic activity, the subject was then switched to Condition B.

Each subject had his/her own individual journal and log book in which the researcher recorded the type of non-aerobic activity individual subjects participated in, the four heart rate measures taken during the non-aerobic activity, and the task each subject completed while in the classroom.

### Condition B (Aerobic Activity)

The treatment Condition was conducted on the next four consecutive research days after Condition A. The treatment in the study included 20 minutes of an aerobic activity. The treatment was personally conducted by the researcher in the gymnasium with each subject individually.

The aerobic activity chosen for each individual subject was first discussed with the classroom teacher. The aerobic activity had to be an activity that the children would engage in for 20 minutes and be considered aerobic as defined earlier. The researcher used the advice of the classroom teachers as to what type of activity subjects would engage in, but was not limited to those specific activities.

During Condition B, subjects were individually transitioned to the gymnasium by the researcher via the use of the subject's individual communication system. The researcher completed each individual treatment (20 minutes of an aerobic activity) with each subject individually.

During Condition B, subject's heart rates were measured and recorded every five minutes, for a total of four times during the 20 minute aerobic activity. The subjects were considered to be in aerobic state if the heart monitor read a heart rate between the bottom limit and upper limit heart rate calculated for each individual subject three out of four times the heart rate was taken and recorded.

Following the aerobic activity, subjects were transitioned back to their classroom via their individualized communication systems, accompanied by the researcher. Once in the classroom the researcher immediately observed for and

that the researcher was not introducing a novel task they had not known success with, therefore, reducing behaviors.

Each subject had his/her own individual journal and log-book for the researcher to record the type of aerobic activity individual subjects participated in, the four heart rate measures taken during the aerobic activity, and the task completed by each subject in the classroom.

### Reliability

A reliability check was conducted during the study. The check involved having the researcher and the head teacher of each individual subject observing and recording the specific dominant behavior expressed by each subject every ten seconds for a total of 90, ten-second intervals (15 minutes). Following the observation of and recording of the specific dominant behavior expressed by each individual subject, data gathered by the researcher and the head teacher were compared and evaluated. Reliability data was collected one time during the study. The following formula (Kazdin, 1982) was used to calculate the reliability between the data gathered by the researcher and the head teacher:

Number of agreements

----- X 100 = % of agreements.

Number of agreements + Number of disagreements

The researcher trained the head teachers how to record the specific dominant behavior of each individual child using the recording sheet devised by the researcher

(see Appendix B). One reliability check was completed with each of the three head teachers based on the availability of the head teacher to complete the reliability check for the amount of time required to do so.

For Subject one, a reliability of 92% was achieved when the data gathered by the researcher and the head teacher was compared. For Subject two, a reliability of 84% was achieved when data gathered by the researcher and the head teacher was compared. For Subject three, a reliability of 86% was achieved when data gathered by the researcher and the head teacher was compared.

Table 1

Agreement Between Researcher and Head Teacher for Subject One on the Expression of Specific Dominant Behaviors for Subject One

	Teacher	Researcher	Agreement	% Agreement
SSE	7	7	7	100%
NSSE	20	23	20	87%
SSNE	36	33	33	92%
NSSNE	27	27	27	100%

Table 2

Agreement Between Researcher and Head Teacher for Subject Two on the  
Expression of Specific Dominant Behaviors for Subject Two

	Teacher	Researcher	Agreement	% Agreement
SSE	68	64	64	94%
NSSE	13	19	13	68%
SSNE	0	2	0	0%
NSSNE	9	5	5	55%

Table 3

Agreement Between Researcher and Head Teacher for Subject Three on the  
Expression of Specific Dominant Behaviors for Subject Three

	Teacher	Researcher	Agreement	% Agreement
SSE	22	26	22	85%
NSSE	51	52	51	98%
SSNE	14	11	11	79%
NSSNE	3	1	1	33%

Table 1 demonstrates that for Subject one, the researcher and the head teacher for Subject one had a high percentage of agreement on all specific dominant

behaviors displayed by Subject one. The researcher and the head teacher for Subject one observed similar specific dominant behavior displayed by Subject one.

Table 2 demonstrates that for Subject two, the researcher and the head teacher for Subject two had a high percentage of agreement only for the specific behaviors of SSE. Table 2 results show that when Subject two displayed a specific dominant behavior at a high frequency, the researcher and the head teacher for Subject two observed the same behavior at a high percentage of agreement, as compared to when Subject two displayed a specific dominant behavior at a low frequency the researcher and the head teacher for Subject two observed the same behavior at a low percentage of agreement. The lack of reliability across the four dimensions requires that Subject Two's overall performance be interpreted with a great deal of caution.

Table 3 demonstrates that for Subject three, the researcher and the head teacher for Subject three had a high percentage of agreement on the three specific behaviors of SSE, NSSE, SSNE, and a low percentage of agreement for the specific behavior of NSSNE. The results of Table 3 show that the researcher and the head teacher for Subject three observed similar behavior displayed by Subject three for three of the specific dominant behaviors at a high percentage of agreement, and one specific dominant behavior at a low percentage of agreement. Table 3 results show that when Subject three displayed a specific dominant behavior at a high frequency, the researcher and the head teacher for Subject three observed the same behavior at a high percentage of agreement, as compared to when Subject three displayed a specific dominant behavior at a low frequency the researcher and the head teacher for Subject three observed the same behavior at a low percentage of agreement.

## CHAPTER 4

### RESULTS

The current study had a limited number of subjects (3). With only three subjects participating in the study the decision was made not to run statistics on the data collected. The results are to be interpreted as individual subjects conducted through a baseline-treatment-baseline (ABA) research design, and the comparison is between baseline-treatment-baseline data. No control group was included in the study due to the fact that each subject acted as his/her own control.

#### Aerobic Activity

The methodology stated that the aerobic activity each subject would participate in to elevate their heart rates to an aerobic level as defined by the American College of Sports Medicine (1990), as cited in Lochbaum and Crews (1995), would be determined by the researcher during the course of the experiment and may change from day to day.

The gymnasium had an electronic treadmill in one corner of the gym. The researcher felt the treadmill would be the safest and most effective activity to elevate the subject's heart rates to an aerobic level. The treadmill had an adjustable speed control, a metal bar the subjects could hold onto as they were using it, and it was surrounded by large foam padded mats should subjects fall while using the treadmill.

All three subjects used only the treadmill for 20 minutes to elevate their heart rates to an aerobic level during Condition B (aerobic) of the study. The consistency of all three subjects using the treadmill gives more strength to the results reported for each subject since all three of the subjects elevated their heart rates by using the



treadmill. Appendix A contains tables of the heart rates for each individual subject for each research day of the study across all Conditions. Table 4 contains the mean heart rate and range per subject across Conditions. Table 4 shows that all three subjects were able to maintain a mean heart rate considered to be aerobic as defined by the American College of Sports Medicine (1990), as reported by Lochbaum and Crews (1995). The American College of Sports Medicine (1990) states that a 60%-90% maximum heart rate is an appropriate intensity to maintain cardiorespiratory fitness based on 20 minutes of exercise in one session, as reported by Lochbaum and Crews (1995). Each subject’s heart rate was individually calculated using the formula in the methodology of the current study under the heading Heart Rate. A bottom limit (60% of the maximum heart rate) and an upper limit (90% of the maximum heart rate) was calculated for each individual subject. Heart rates that fell between the bottom and upper limit for each individual Subject were considered to be an aerobic heart rate.

Table 4

Mean Heart Rate, Range, and Percent Heart Rate Maximum by Subject Across Conditions

	Condition A			Condition B			Condition A		
	Mean	Range	% Max Heart Rate	Mean	Range	% Max Heart Rate	Mean	Range	% Max Heart Rate
Subject 1	113	97-122	51%	143	133-159	65%	113.6	96-121	52%
Subject 2	113.4	101-122	52%	152.8	121-163	70%	111.4	105-117	51%
Subject 3	116.8	104-135	53%	149.4	136-164	68%	116.3	112-122	53%

Table 4 data show that during Condition A all subjects had an average heart rate below 60% of the maximum heart rate, indicating that all subjects were participating in the non-aerobic activity at a non-aerobic level. During Condition B, all subjects had an average heart rate above 60% of the maximum heart rate, indicating that all subjects were participating in the aerobic activity at an aerobic level. During Condition A again, all subjects had an average heart rate below 60% of the maximum heart rate, indicating that all subjects were participating in the non-aerobic activity at a non-aerobic level.

As well as recording the heart rates of all three of the subjects each research day across Conditions, the researcher noticed other observable physical characteristics during Condition B of the study. Subject one displayed the physical characteristics of sweating and shortness of breath; Subject two displayed redness of the face, sweating and shortness of breath; Subject three displayed redness of the face, sweating, and shortness of breath. These observable physical characteristics support the fact that all subjects consistently maintained an aerobic heart rate.

#### Dominant Behavior Data Collection

Data were collected on the dominant behavior displayed by a subject during each ten-second interval for a total of 90, ten-second intervals (15 minutes) of observation in the subjects' regular classroom immediately following the non-aerobic (A) or aerobic (B) Condition (a total of 90, ten-second intervals per subject per research day were recorded). Dominant behavior was defined as the behavior each subject displayed 60% of the time or greater (or six seconds or longer) during a ten-second interval. Dominant behavior of the child was determined for every ten-second

interval throughout the study for all subjects for all Conditions (see Appendix B for the data recording sheet of dominant behavior).

The dominant behavior of the individual subjects was determined to be one of four behaviors. The child might have been expressing the dominant behavior of: Self-stimulating and engaged in the activity (SSE), Not self-stimulating and engaged in the activity (NSSE), Self-stimulating and Not engaged in the activity (SSNE), or Not self-stimulating and Not engaged in the activity (NSSNE). The data were further separated in the analysis into the number of ten-second intervals, out of 90, individual subjects displayed the dominant behavior of Self-stimulating behaviors (SS) or No self-stimulating behaviors (NSS); and whether the child was Engaged in the activity (E) or Not engaged in the activity (NE).

Tables 5, 7, and 9 contain the results of the data collected on dominant behavior during the observation in the child's regular classroom, following the non-aerobic and aerobic Conditions. Tables 6, 8, and 10 contain the results of the data collected during the observation in the child's regular classroom following the non-aerobic and aerobic Conditions of the study for each individual subject on the four further separated behaviors of SS, NSS, E, NE across the Conditions of the study. Data is also depicted in graphical format in Figures 1-18. In Tables 5, 7, and 9 the behaviors of SSE, NSSE, SSNE, and NSSNE for each research day add up to 90. As stated earlier, there are 90, ten-second intervals in the observation following the non-aerobic and aerobic Conditions on a given research day of the study. Also in Tables 6, 8, and 10 the behaviors of SS and NSS add up to 90, and the behaviors of E and NE add up to 90. One way in which to report the results of the study were

comparisons between dominant behavior categories. Comparisons made in this manner were able to compare self-stimulation with an engaged and non-engaged activity; non self-stimulating with an engaged and non-engaged activity; an engaged activity with amount of self-stimulation and non self-stimulation present; and a non engaged activity with the amount of self-stimulation and non self-stimulation present.

### Subject One

Subject one's data is determined through the four comparisons discussed above. When SSE is compared to SSNE (see Table 5 and Figures 1-3), the data collected for Subject one show that in Condition A (non-aerobic), Subject one demonstrated a dominant behavior of SSNE behavior four out of four research days. In Condition B (aerobic), Subject one demonstrated a dominant behavior of SSNE behavior three out of four research days. When placed back into Condition A (non-aerobic) again, Subject one demonstrated a dominant behavior of SSNE behavior three out of four research days. When SSE and SSNE are compared for Subject one across all Conditions, Subject one demonstrated the dominant behavior of SSNE with more intervals during more research days than SSE, and demonstrated non-engagement over engagement in the activity while self-stimulating. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity had little influence on the number of intervals expressing the amount of engagement or non-engagement Subject one did while self-stimulating across Conditions.

Table 5

Number of Intervals in which the Specific Behavior was Dominant for Subject One

	CONDITION A				CONDITION B				CONDITION A			
SSE	2	8	2	11	4	15	4	3	7	15	15	5
NSSE	32	36	4	42	34	51	28	49	23	70	18	12
SSNE	30	28	46	24	34	15	19	23	33	4	37	44
NSSNE	26	18	38	13	18	9	39	15	27	1	20	29
DATE	3/26	3/27	4/2	4/4	4/9	4/10	4/11	4/16	4/17	4/18	4/23	4/24
RESEARCH DAY	1	2	3	4	5	6	7	8	9	10	11	12

Note. SSE = Self-Stimulating/Engaged  
NSSE = Not Self-Stimulating/Engaged  
SSNE = Self-Stimulating/Not Engaged  
NSSNE = Not Self-Stimulating/Not Engaged

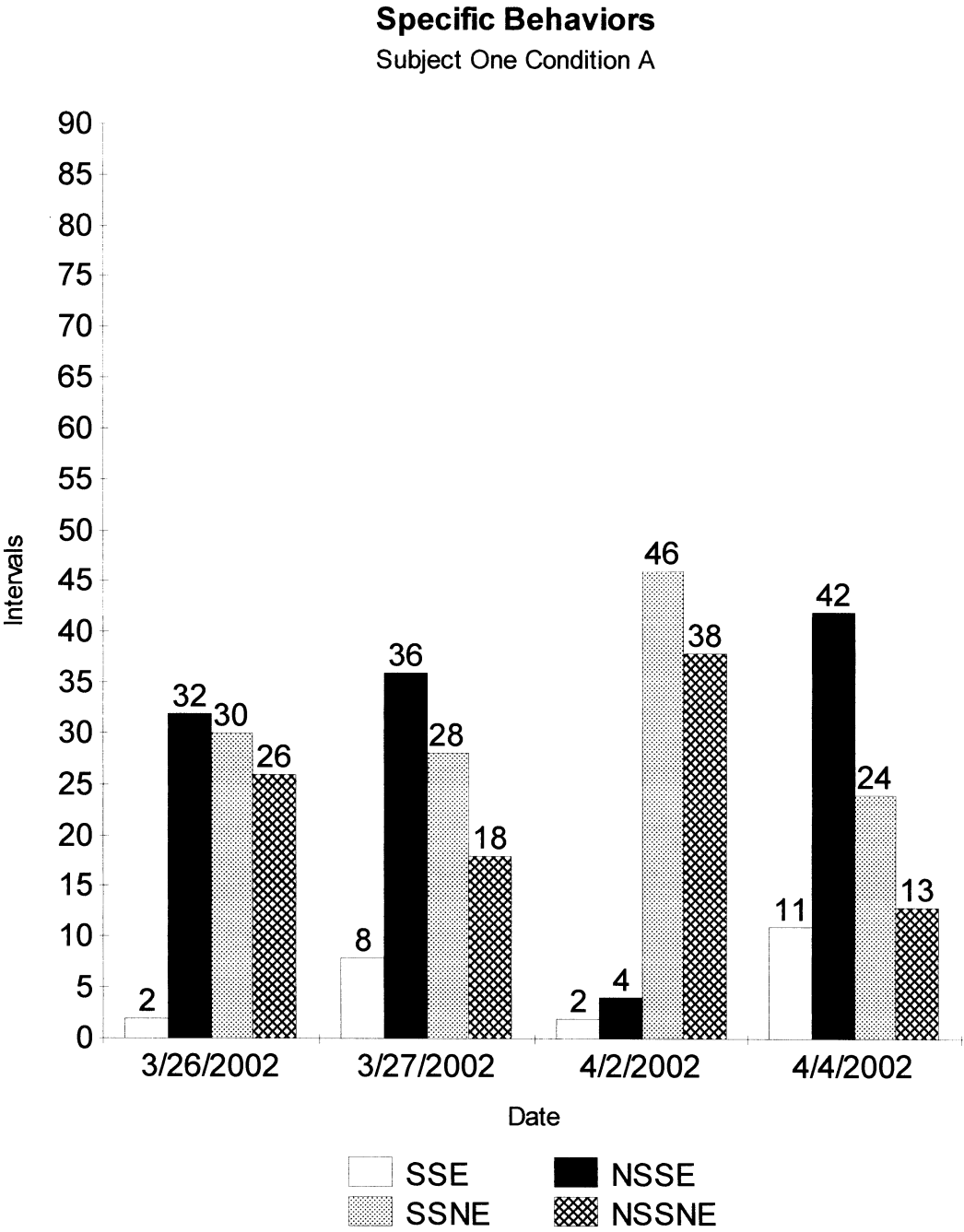


Figure 1. The specific dominant behavior Subject One displayed during Condition A.

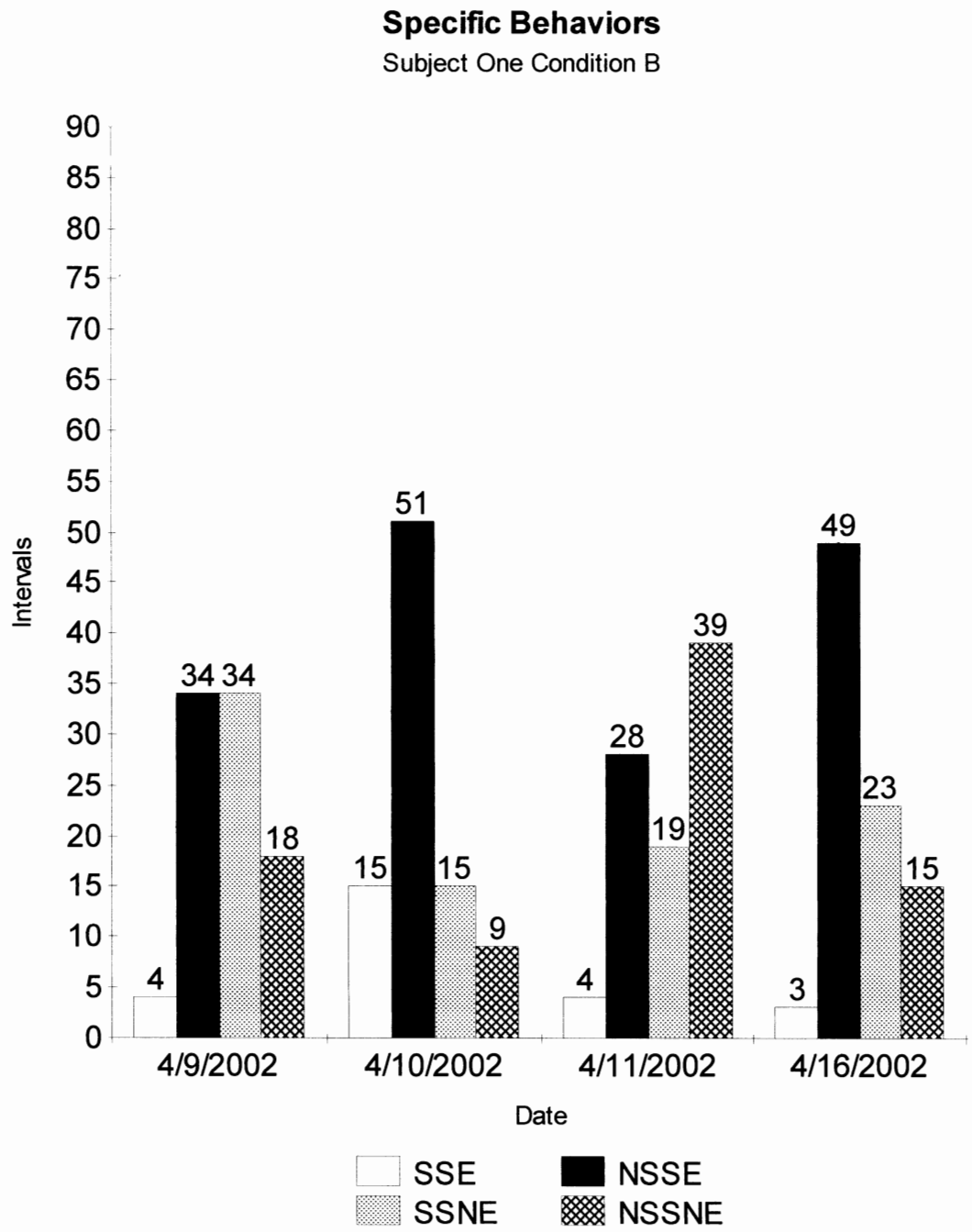


Figure 2. The specific dominant behavior Subject One displayed during Condition B.

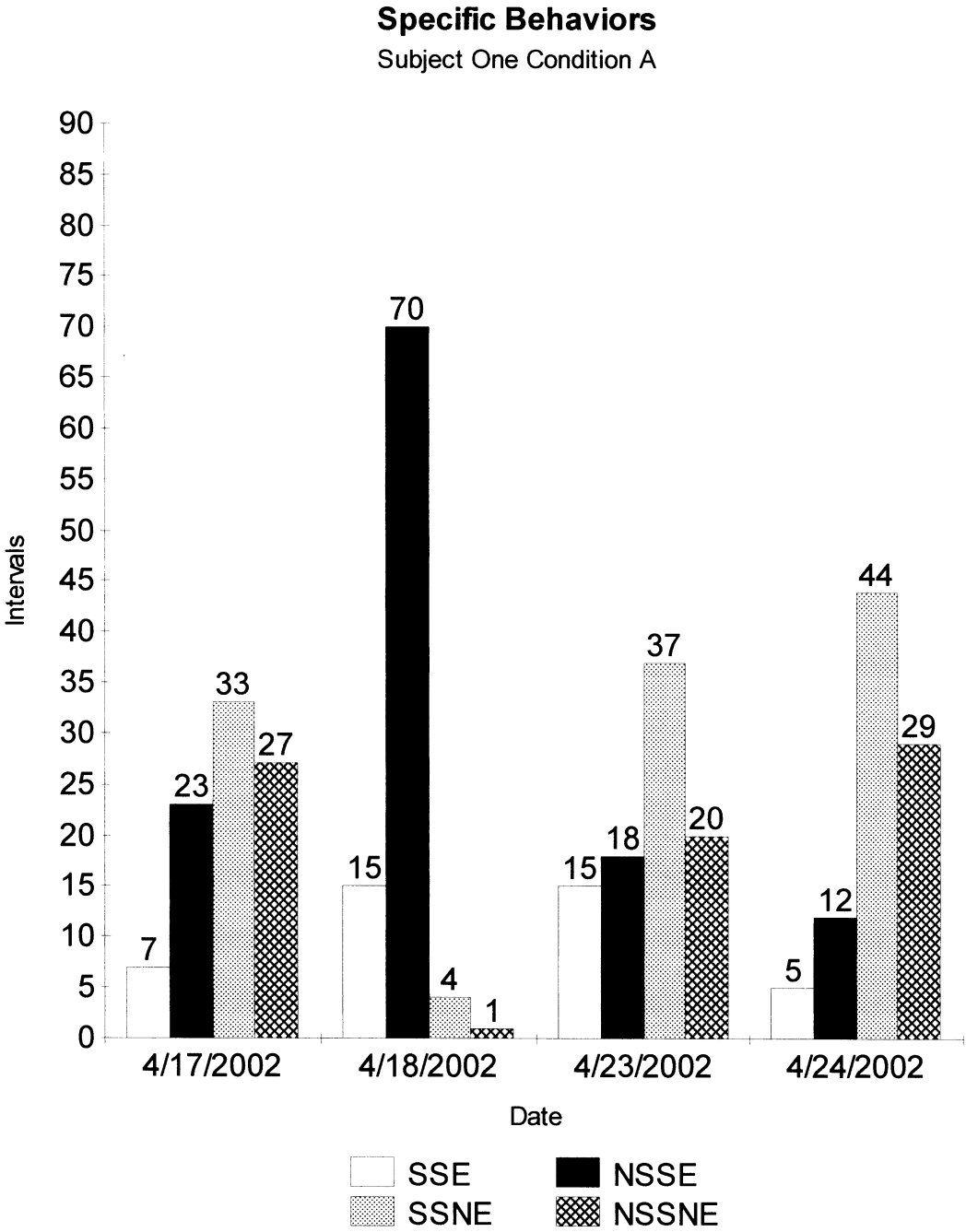


Figure 3. The specific dominant behavior Subject One displayed during Condition A again.



When NSSE is compared to NSSNE, the data collected for Subject one show that in Condition A, Subject one demonstrated a dominant behavior of NSSE behavior three out of four research days. In Condition B, Subject one demonstrated a dominant behavior of NSSE behavior two out of four research days with one research day displaying NSSE and NSSNE be equal. In Condition A again, Subject one demonstrated a dominant behavior of NSSNE behavior three out of four research days. When NSSE and NSSNE are compared for Subject one across all Conditions, Subject one does not demonstrate a dominant behavior with NSSE and NSSNE having the same number of research days and was equally not engaged as much as engaged in an activity while not self-stimulating. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did little to influence the number of intervals expressing the amount of engagement or non-engagement Subject one did while not self-stimulating across Conditions.

When SSE is compared to NSSE, the data collected for Subject one show that in Condition A, Subject one demonstrated a dominant behavior of NSSE four out of four research days. In Condition B, Subject one demonstrated a dominant behavior of NSSE four out of four research days. In Condition A again, Subject one demonstrated a dominant behavior of NSSE four out of four research days. When SSE and NSSE are compared for Subject one across all Conditions, Subject one demonstrated a dominant behavior of NSSE with more intervals during more research days than SSE, and demonstrated non self-stimulating behaviors over stimulating behaviors while being engaged in an activity. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did not

influence the number of intervals expressing the amount of self-stimulation or non self-stimulation Subject one did while being engaged in an activity across Conditions.

When SSNE is compared to NSSNE, the data collected for Subject one show that in Condition A, Subject one demonstrated a dominant behavior of SSNE four out of four research days. In Condition B, Subject one demonstrated a dominant behavior of SSNE three out of four research days. In Condition A again, Subject one demonstrated a dominant behavior of SSNE four out of four research days. When SSNE and NSSNE are compared for Subject one across all Conditions, Subject one demonstrated a dominant behavior of SSNE with more intervals during more research days than NSSNE, and demonstrated self-stimulation over non self-stimulation while being non-engaged in an activity. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did little to influence the number of intervals expressing the amount of self-stimulating behaviors of Subject one while being non-engaged in an activity across Conditions.

Subject one increased in SSE behavior intervals from Condition A to Condition B, as well as increased in SSE behavior intervals from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity had a small influence on the SSE behavior intervals of Subject one across Conditions. Subject one increased in NSSE behavior intervals from Condition A to Condition B, and decreased in NSSE behavior intervals from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity had a small influence on the NSSE behavior intervals of Subject one across Conditions. Subject one

decreased in SSNE behavior intervals from Condition A to Condition B, and increased in SSNE behavior intervals from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity had a small influence on the number of SSNE behavior intervals of Subject one across Conditions. Subject one decreased in NSSNE behavior intervals from Condition A to Condition B, as well as decreased in NSSNE behavior intervals and from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity had a small influence on the number of NSSNE behavior intervals of Subject one across Conditions. Results of the data for Subject one indicated that the introduction of an aerobic activity minimally influenced Subject one's behavior.

Results are also reported for the categories that were extrapolated from the original data collection results. The categories of SS, NSS, E, and NE were compared (see Table 6 and Figures 4-6). The category of SS was compared to NSS and the category of E was compared to NE across all Conditions of the study. A further comparison of the data reviewed the comparison between self-stimulation and engagement to determine if SS could predict Subject one's engagement or non-engagement in an activity. The category of SS was determined by adding SSE and SSNE. The category of NSS was determined by adding NSSE and NSSNE. The category of E was determined by adding SSE and NSSE. And the category of NE was determined by adding SSNE and NSSNE. This is true for all subject's extrapolated data in Tables 5,7, and 9.

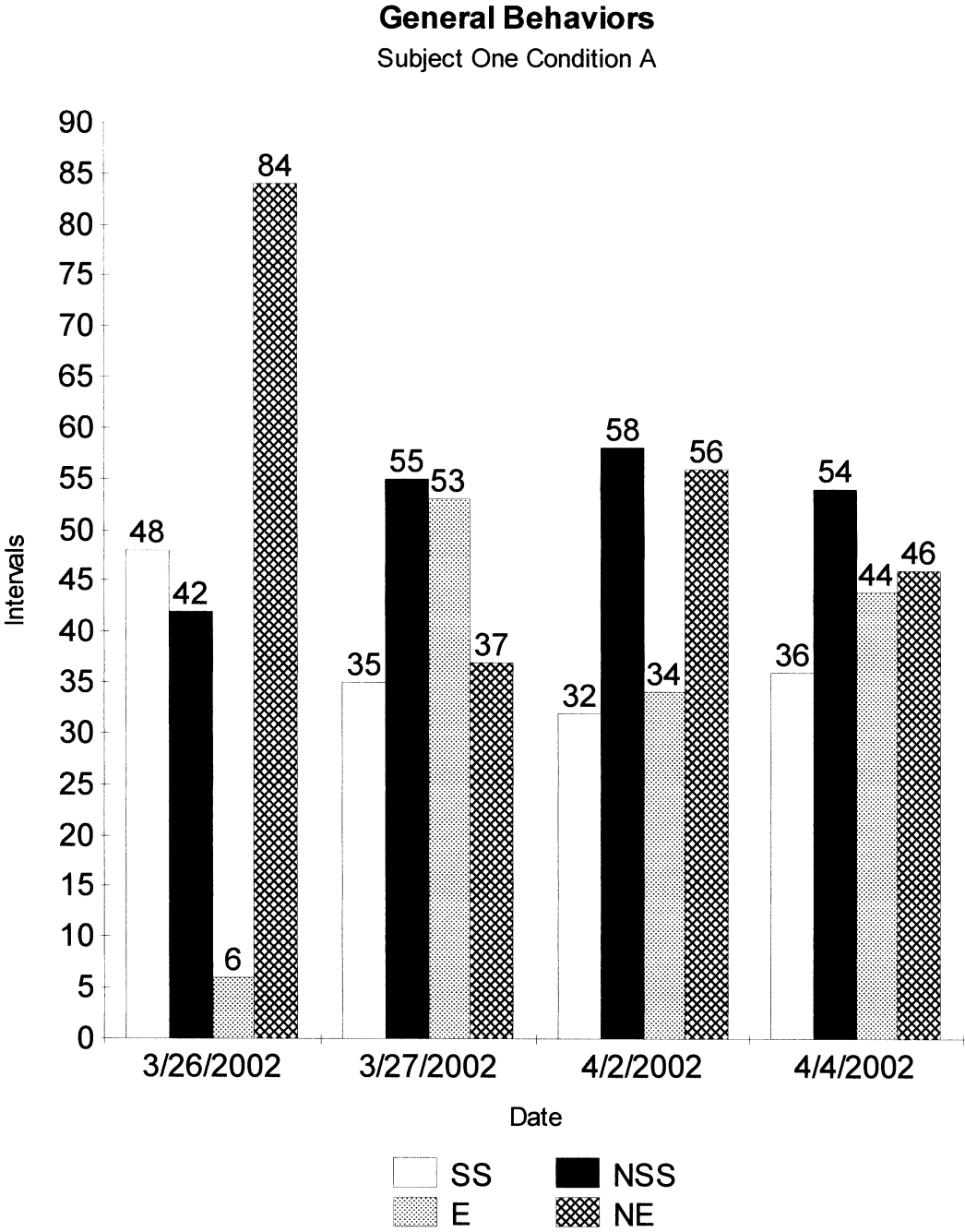


Figure 4. The general behaviors Subject One displayed during Condition A.

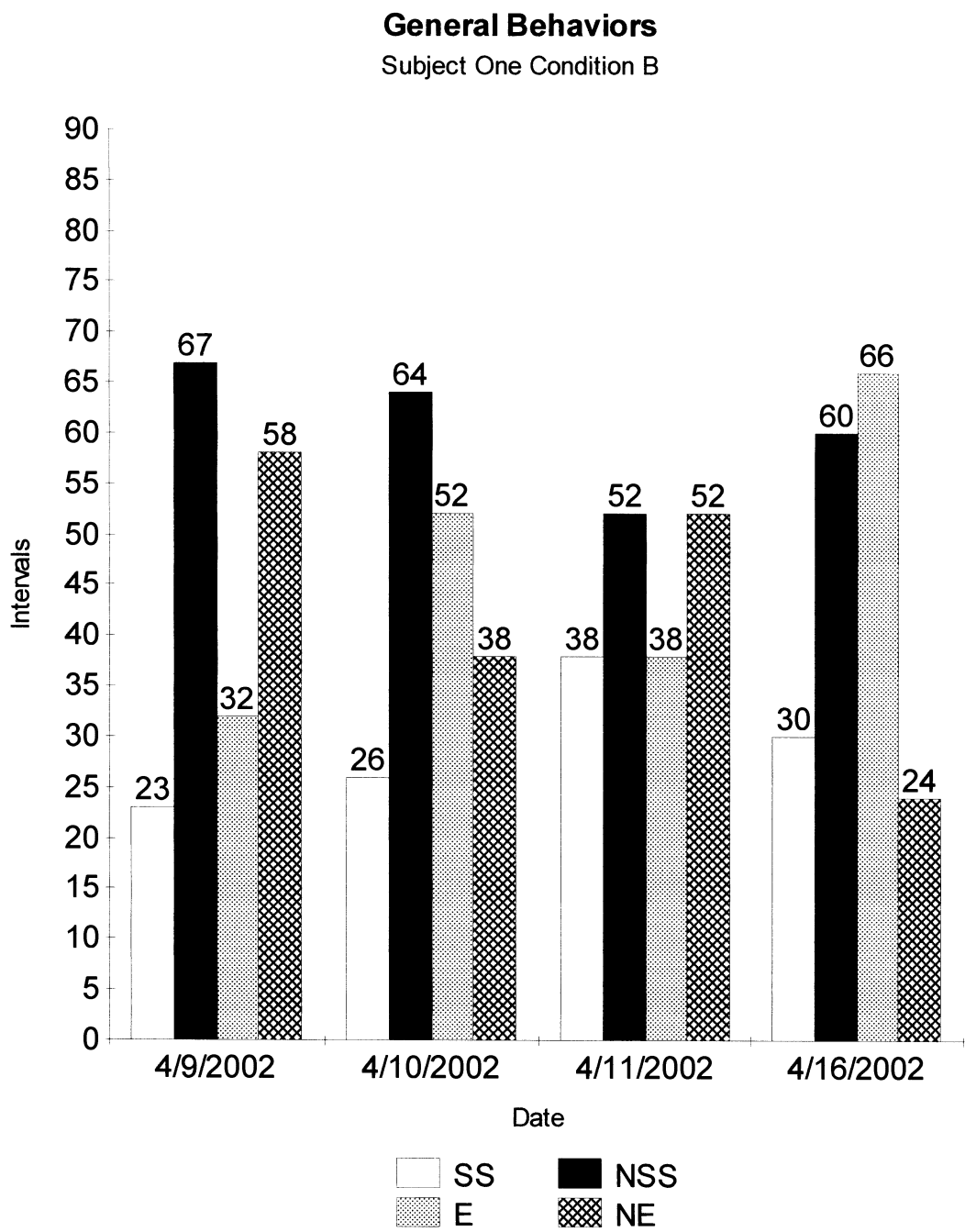


Figure 5. The general behaviors displayed by Subject One during Condition B.

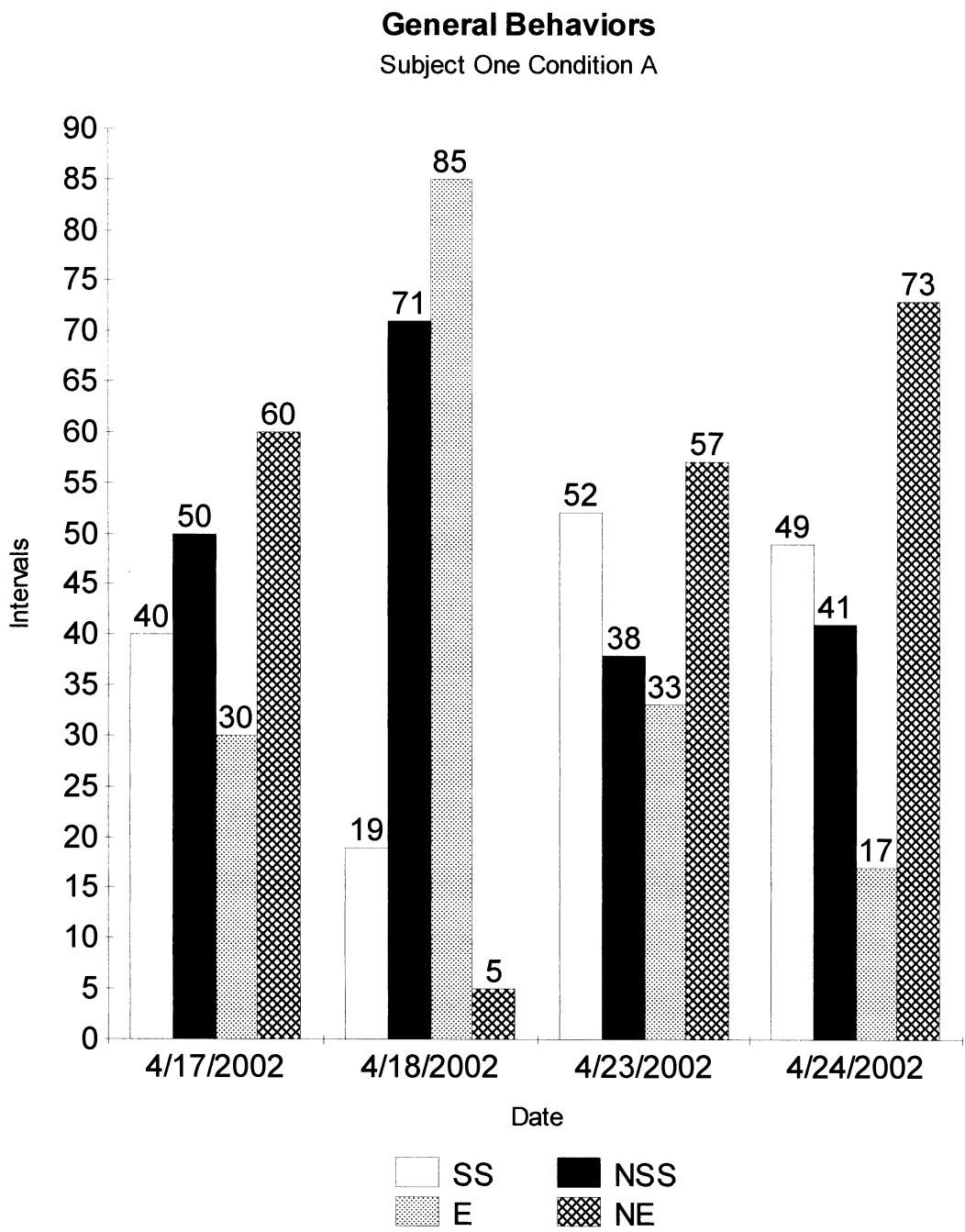


Figure 6. The general behaviors displayed by Subject One during Condition A again.

When SS is compared to NSS, the data collected for Subject one showed that in Condition A, Subject one demonstrated a dominant behavior of NSS three out of four research days and a dominant behavior of NE three out of four research days. In Condition B, Subject one demonstrated a dominant behavior of NSS four out of four research days and no other dominant behavior as E and NE both were demonstrated two out of four research days. In Condition A again, Subject one demonstrated no dominant behavior as SS and NSS both were demonstrated two out of four research days and a dominant behavior of NE three out of four research days. When SS and NSS are compared for Subject one across all Conditions, Subject one demonstrated non self-stimulating behavior with more intervals during more research days than stimulating behavior. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did little to influence the number of intervals expressing the amount non self-stimulating behaviors of Subject one across Conditions. Self-stimulation decreased from the A Condition to the B Condition when individual dates are looked at and compared. However, Subject one surpassed the previous A Condition SS level when the aerobic level was eliminated and a return to a non-aerobic Condition was resumed.

Comparison results also showed that when E and NE are compared for Subject one across all Conditions, Subject one demonstrated non-engaged behavior with more intervals during more research days than engaged behavior in an activity. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did little to influence the engaged or non-engaged behaviors in an activity for Subject one across Conditions. Engagement in an activity increased

from the A Condition to the B Condition when individual dates are looked at and compared. However, Subject one did return to previous A Condition E level when the aerobic activity was eliminated and a return to a non-aerobic Condition was resumed.

As self-stimulation decreased from Condition A to Condition B (from one out of four research days to zero out of four research days), engagement in an activity increased from Condition A to Condition B (from one out of four research days to two out of four research days). From Condition B to Condition A again, self-stimulating behavior increased (from zero out of four research days to two out of four research days), while engagement in an activity decreased (from two out of four research days to one out of four research days). The results of the data minimally show the ability of self-stimulation to predict Subject one's engagement in an activity.

The effect, though small, follows the expectation that the introduction of an aerobic activity will reduce self-stimulating behavior in children diagnosed with autism. A further effect of the introduction of the aerobic activity was the engagement level in an activity increased, which also follows the professional literature expectation.

### Subject Two

Subject two's data were analyzed using the same four comparisons discussed above. When SSE is compared to SSNE (see Table 7 and Figures 7-9), the data collected for Subject two show that in Condition A, Subject one demonstrated a dominant behavior of SSNE behavior three out of four research days. In Condition B,



Subject two demonstrated a dominant behavior of neither SSE nor SSNE due to the fact that both behaviors were displayed two out of four research days. In Condition A again, Subject two demonstrated a dominant behavior of SSE behavior three out of four research days. When SSE and SSNE are compared for Subject two across all Conditions, Subject two does not demonstrate a dominant behavior with SSE and SSNE having the same number of research days, and was not engaged as much as engaged while self-stimulating. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity minimally influenced the number of intervals expressing the amount of engagement or non-engagement Subject two did while self-stimulating across Conditions.

Table 7

Number of Intervals in which the Specific Behavior was Dominant for Subject Two

	CONDITION A				CONDITION B				CONDITION A			
SSE	34	37	29	27	25	24	28	64	49	19	35	40
NSSE	2	9	12	0	23	7	14	19	7	5	26	19
SSNE	46	31	38	56	22	44	44	2	29	57	25	17
NSSNE	8	13	11	7	20	15	4	5	5	9	4	14
DATE	3/26	3/27	3/28	4/2	4/3	4/10	4/11	4/16	4/17	4/18	4/23	4/24
RESEARCH DAY	1	2	3	4	5	6	7	8	9	10	11	12

Note. SSE = Self-Stimulating/Engaged  
NSSE = Not Self-Stimulating/Engaged  
SSNE = Self-Stimulating/Not Engaged  
NSSNE = Not Self-Stimulating/Not Engaged

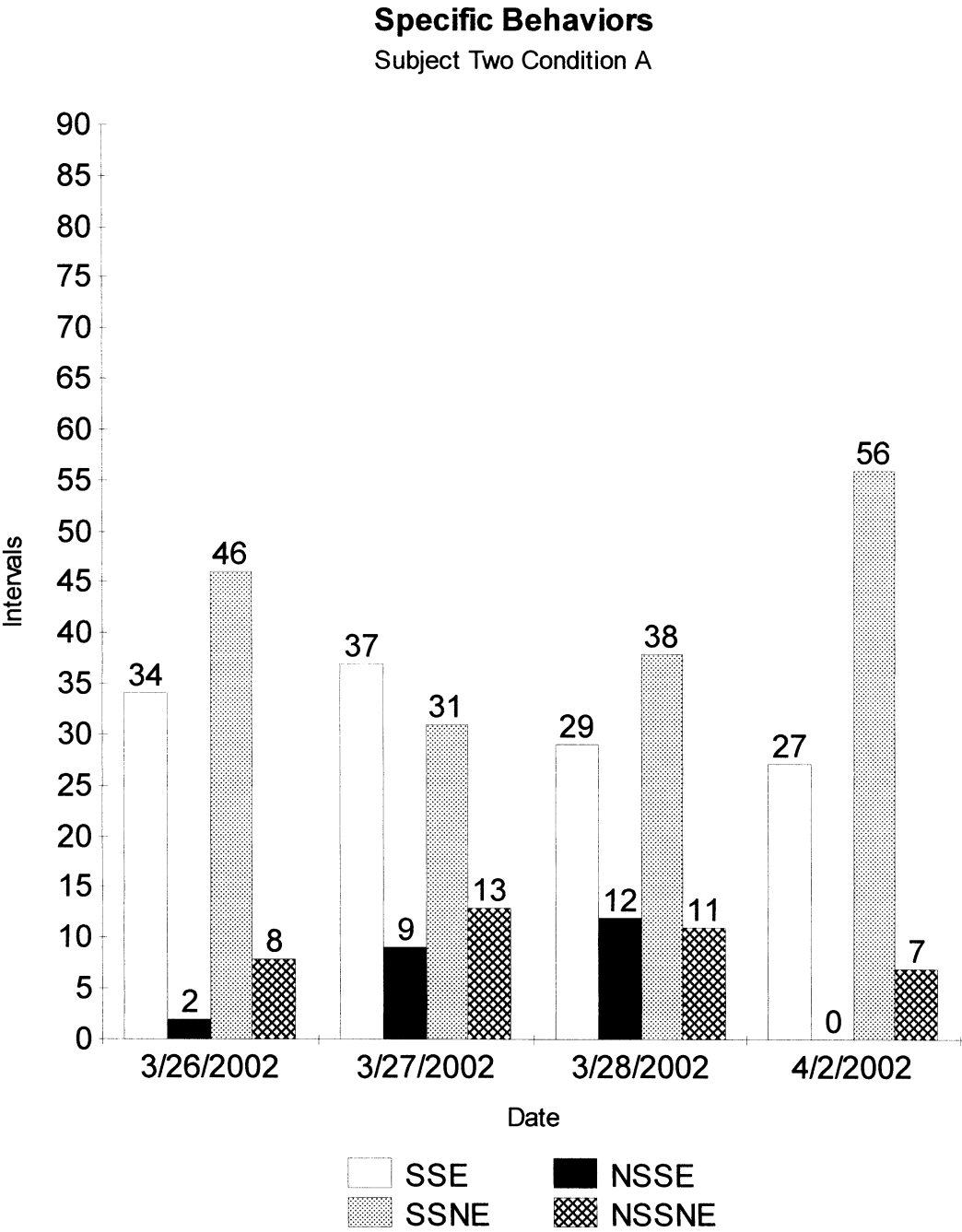


Figure 7. The specific behaviors displayed by Subject Two during Condition A.

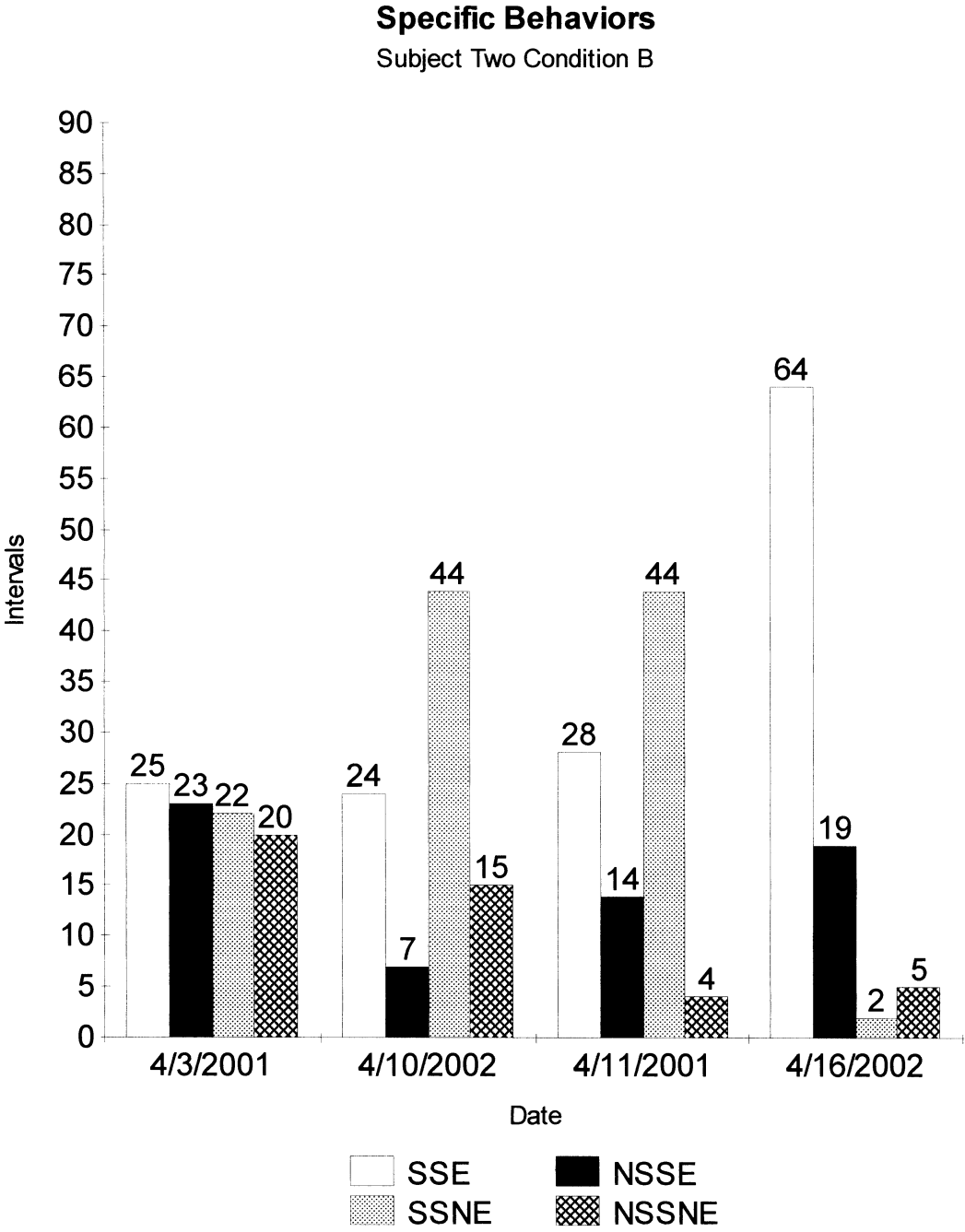


Figure 8. The specific behaviors displayed by Subject two during Condition B

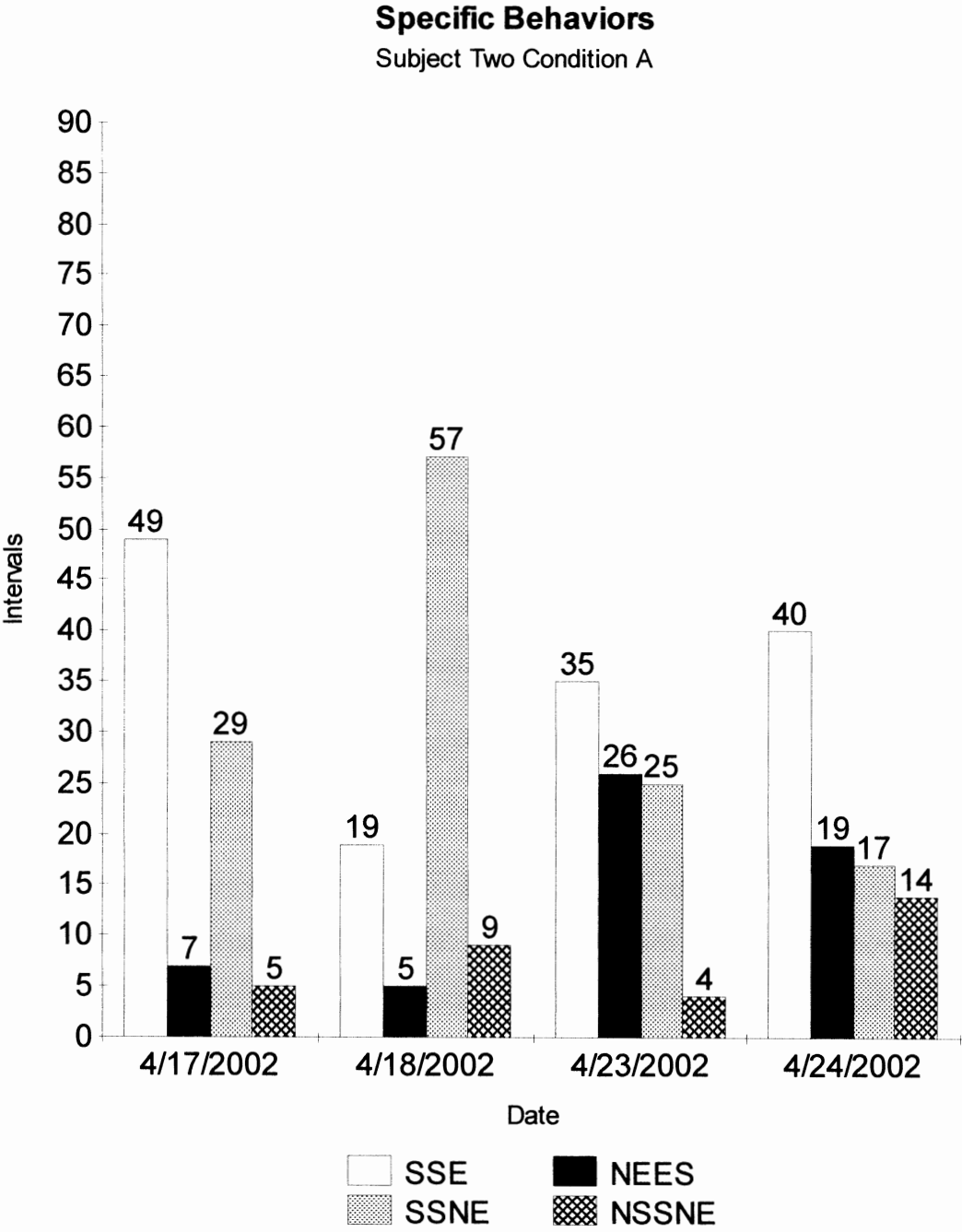


Figure 9. The specific behaviors displayed by Subject Two during Condition A again.

When NSSE is compared to NSSNE, the data collected for Subject two shows that in Condition A, Subject two demonstrated a dominant behavior of NSSNE behavior three out of four research days. In Condition B, Subject two demonstrated a dominant behavior of NSSE three out of four research days. In Condition A again, Subject two demonstrated a dominant behavior of NSSE three out of four research days. When NSSE and NSSNE are compared for Subject two across all Conditions, Subject two demonstrates a dominant behavior of NSSE with more intervals during more research days than NSSNE, and demonstrated engagement over non-engagement while not self-stimulating. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity had a moderate influence on the number of intervals expressing the amount of engagement or non-engagement in an activity Subject two did while not self-stimulating across Conditions.

When SSE is compared to NSSE, the data collected for Subject two shows that in Condition A, Subject two demonstrated a dominant behavior of SSE four out of four research days. In Condition B, Subject two demonstrated a dominant behavior of SSE four out of four research days. In Condition A again, Subject two demonstrated a dominant behavior of SSE four out of four research days. When SSE and NSSE are compared for Subject two across all Conditions, Subject two demonstrated a dominant behavior of SSE with more intervals during more research days than NSSE, and demonstrated self-stimulation over non self-stimulation while being engaged in an activity. Results also indicated that when comparing the

Conditions (A-B-A), the introduction of an aerobic activity had no influence on the number of intervals expressing the amount of self-stimulation or non self-stimulation Subject two did while being engaged in an activity across Conditions.

When SSNE is compared to NSSNE, the data collected for Subject two shows that in Condition A, Subject two demonstrated a dominant behavior of SSNE four out of four research days. In Condition B, Subject two demonstrated a dominant behavior of SSNE three out of four research days. In Condition A again, Subject two demonstrated a dominant behavior of SSNE four out of four research days. When SSNE and NSSNE are compared for Subject two across all Conditions, Subject two demonstrated a dominant behavior of SSNE with more intervals during more research days than NSSNE, and demonstrated self-stimulation over non self-stimulation while being non-engaged in an activity. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity minimally influenced the number of intervals expressing the amount of self-stimulation and non self-stimulation Subject two did while not engaging in an activity across Conditions.

Subject two minimally decreased in the number of SSE behavior intervals from Condition A to Condition B, and minimally increased in the number of SSE behavior intervals from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity minimally influenced the number of SSE behavior intervals of Subject two across Conditions. Subject two increased in the number of NSSE behavior intervals from Condition A to Condition B, and minimally decreased in the number of NSSE behavior intervals from Condition B back to Condition A again, indicating that the

introduction of an aerobic activity minimally influenced the number of NSSE behavior intervals of Subject two across Conditions. Subject two decreased in the number of SSNE behavior intervals from Condition A to Condition B, and minimally increased in the number of SSNE behavior intervals from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity had a small influence on the number of SSNE behavior intervals of Subject two across Conditions. Subject two neither increased nor decreased the number of NSSNE behavior intervals from Condition A to Condition B, and from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity did not influence the number of NSSNE behavior intervals of Subject two across Conditions. Results of the data for Subject two indicated that the introduction of an aerobic activity did little to influence Subject two's behavior.

Results are also reported for the categories that were extrapolated from the original data collection results. The categories of SS, NSS, E, and NE were looked at and compared (see Table 8 and Figures 10-12). The category of SS was compared to NS, and the category of E was compared to NE across all Conditions of the study.



Table 8

Accumulated Intervals for General Behavior Categories for Subject Two

	CONDITION A				CONDITION B				CONDITION A			
SS	80	68	67	83	47	68	72	68	78	76	60	57
NSS	10	22	23	7	43	22	18	22	12	14	30	33
E	36	46	41	27	48	31	42	81	56	24	61	59
NE	54	44	49	63	42	59	48	9	34	66	29	31
DATE	3/26	3/27	3/28	4/2	4/3	4/10	4/11	4/16	4/17	4/18	4/23	4/24
RESEARCH DAY	1	2	3	4	5	6	7	8	9	10	11	12

Note. SS = Self-Stimulating  
NSS = Not Self-Stimulating  
E = Engaged  
NE = Not Engaged

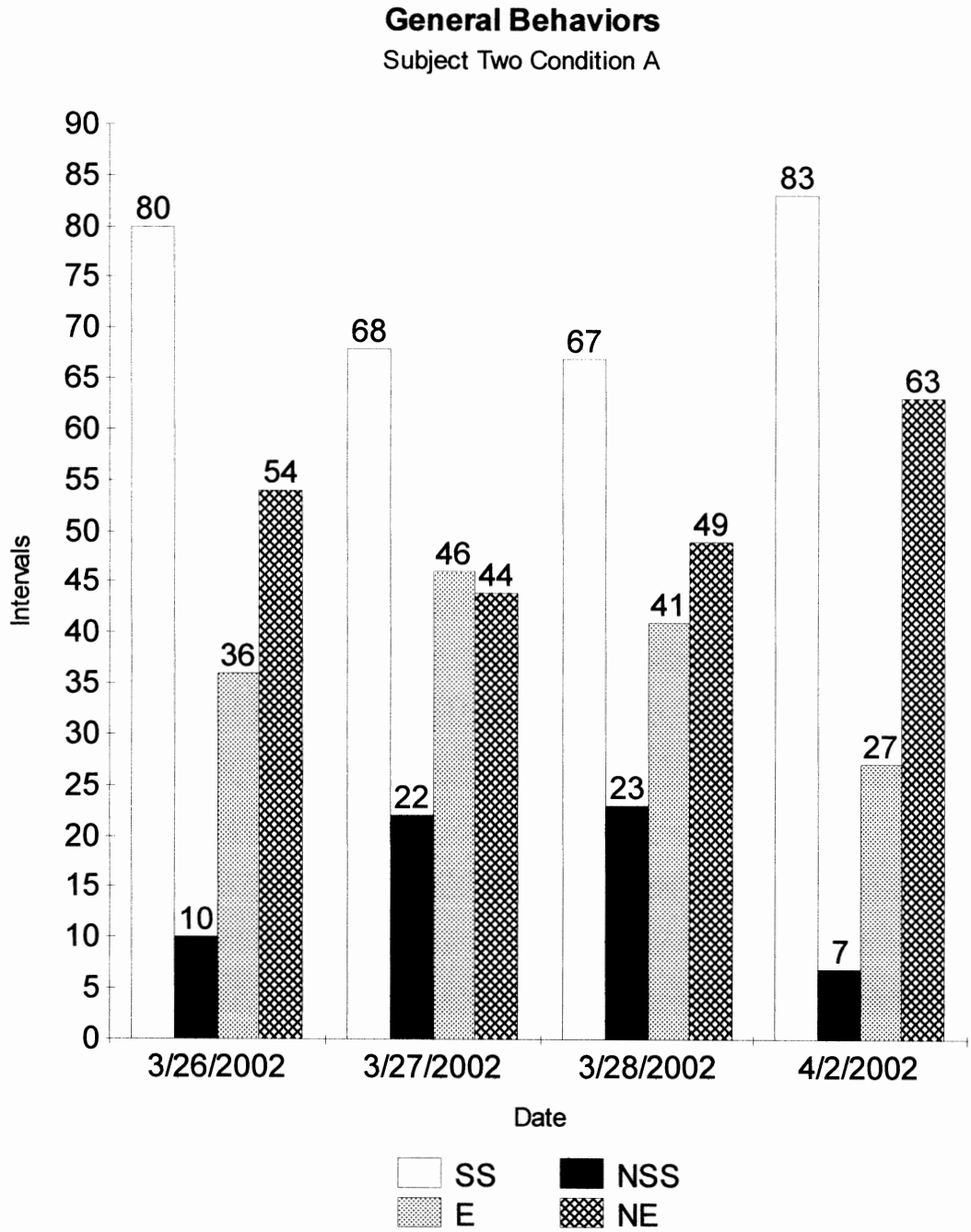


Figure 10. The general behaviors displayed by Subject Two during Condition A.

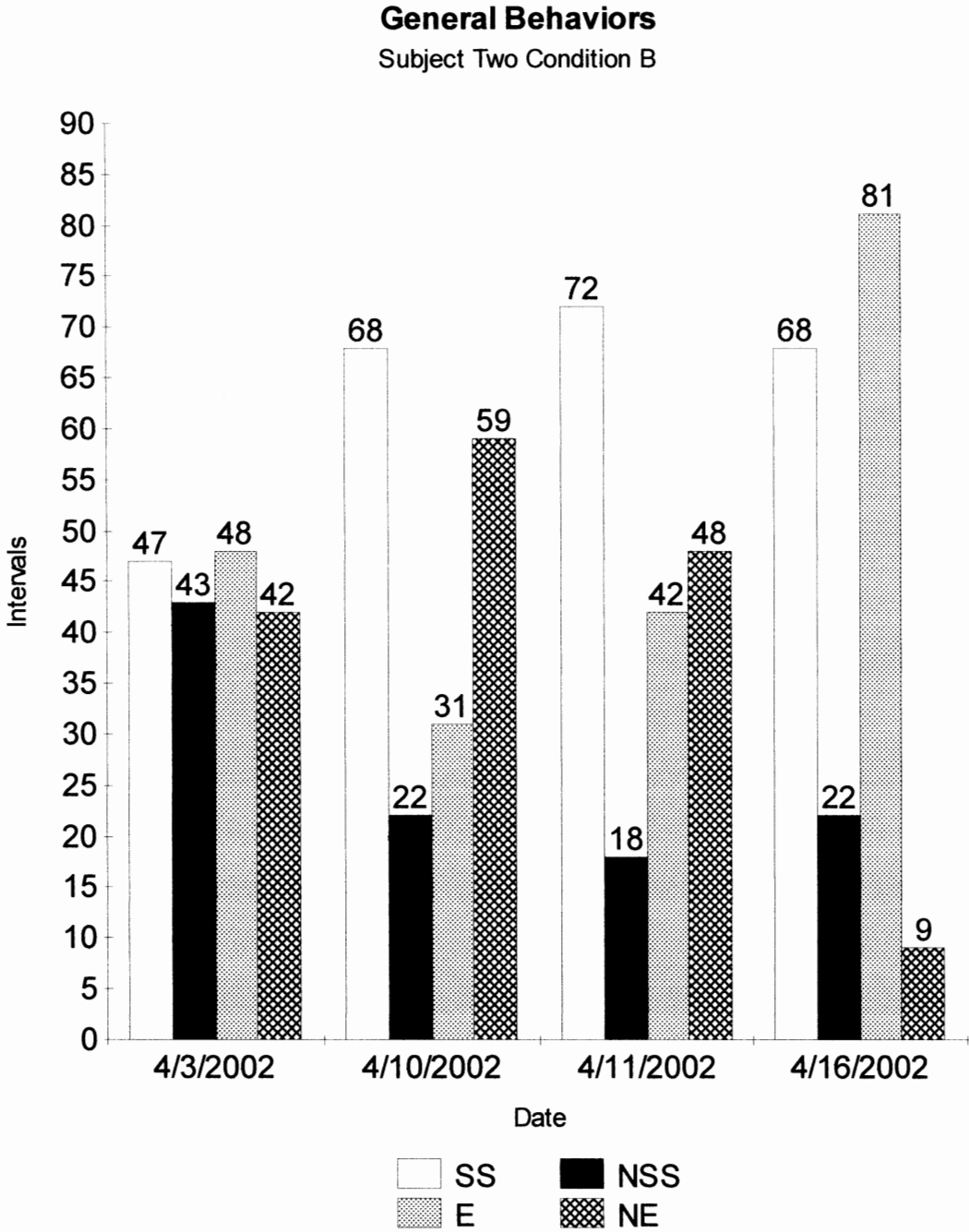


Figure 11. The general behaviors displayed by Subject Two during Condition B.

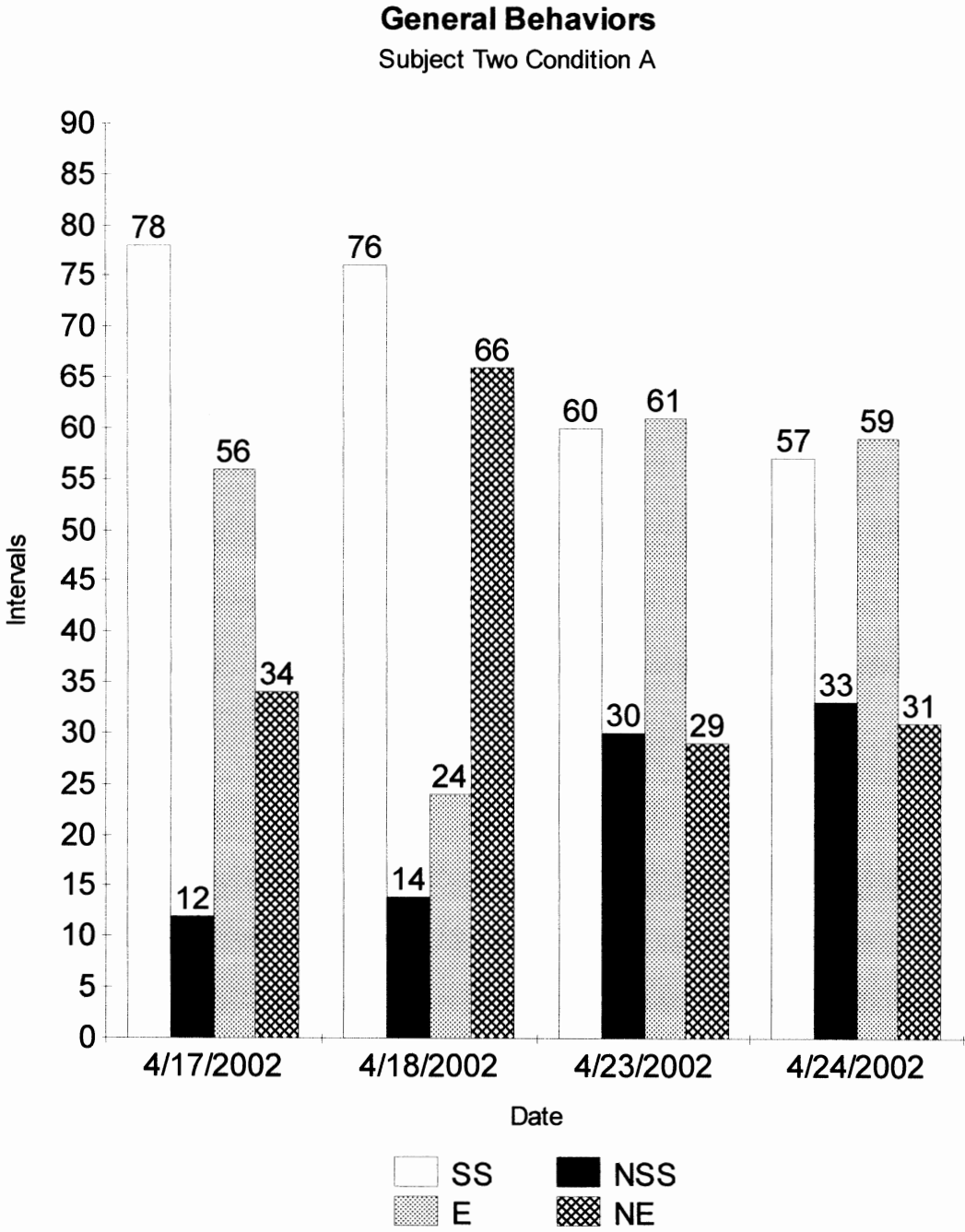


Figure 12. The general behaviors displayed by Subject Two during Condition A again.

When SS is compared to NSS, the data collected for Subject two show that in Condition A, Subject one demonstrated a dominant behavior of SS four out of four research days and a dominant behavior of NE three out of four research days. In Condition B, Subject two demonstrated a dominant behavior of SS four out of four research days, and was equally engaged and non-engaged in an activity, indicating no dominant behavior between E and NE. In Condition A again, Subject two demonstrated a dominant behavior of SS four out of four research days and a dominant behavior of E three out of four research days. When SS and NSS are compared for Subject two across all Conditions, Subject two demonstrated self-stimulating behavior with more intervals during more research days than non self-stimulating behavior. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did little to influence self-stimulating and non self-stimulating behaviors of Subject two across Conditions. Self-stimulation was consistently the dominant behavior when individual dates are looked at and compared. Comparison results also showed that when E and NE are compared for Subject two across all Conditions, Subject two demonstrated no dominant behavior between E and NE in an activity, with E and NE having the same number of research days. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity had a small influence on engaged or non-engaged behaviors in an activity for Subject two. Engagement in an activity increased from Condition A to Condition B, and from Condition B to Condition A again when individual dates are looked at and compared.

As self-stimulation was consistent from Condition A to Condition B (four out of four research days in Condition A and Condition B), engagement in an activity increased from Condition A to Condition B (from one out of four research days to two out of four research days). From Condition B to Condition A again, self-stimulation was consistent (four out of four research days in Condition B and Condition A), while engagement in an activity increased (from two out of four research days to three out of four research days). The results of the data show no ability of self-stimulation to predict Subject two's engagement in an activity.

The effect, though small, of Subject two's engagement in an activity increasing from Condition A to Condition B and from Condition B back to Condition A again, follows the expectation stated by other professionals that the introduction of an aerobic activity may increase engaged time in an activity for children diagnosed with autism.

### Subject Three

Subject three's data were analyzed through the four comparisons discussed above. When SSE is compared to SSNE (see Table 9 and Figures 13-15), the data collected for Subject three show that in Condition A, Subject three demonstrated a dominant behavior of SSE three out of four research days. In Condition B, Subject three demonstrated a dominant behavior of SSE three out of four research days. In Condition A again, Subject three demonstrated a dominant behavior of SSE four out of four research days. When SSE and SSNE are compared for Subject three across all Conditions, Subject three demonstrated the dominant behavior of SSE with more intervals during more research days than SSNE, and demonstrated engagement over

non-engagement behavior while self-stimulating. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did not influence the amount of engagement or non-engagement Subject three did while self-stimulating.

Table 9

Number of Intervals in which the Specific Behavior was Dominant for Subject Three

	CONDITION A				CONDITION B				CONDITION A			
SSE	29	26	27	35	27	17	28	26	27	32	32	22
NSSE	54	49	42	20	36	53	40	52	52	40	54	57
SSNE	7	10	21	35	26	19	22	11	10	14	4	6
NSSNE	0	5	0	0	1	1	0	1	1	4	0	5
DATE	3/26	3/27	4/2	4/3	4/4	4/10	4/11	4/16	4/17	4/18	4/23	4/24
RESEARCH DAY	1	2	3	4	5	6	7	8	9	10	11	12

Note. SSE = Self-Stimulating/Engaged  
NSSE = Not Self-Stimulating/Engaged  
SSNE = Self-Stimulating/Not Engaged  
NSSNE = Not Self-Stimulating/Not Engaged

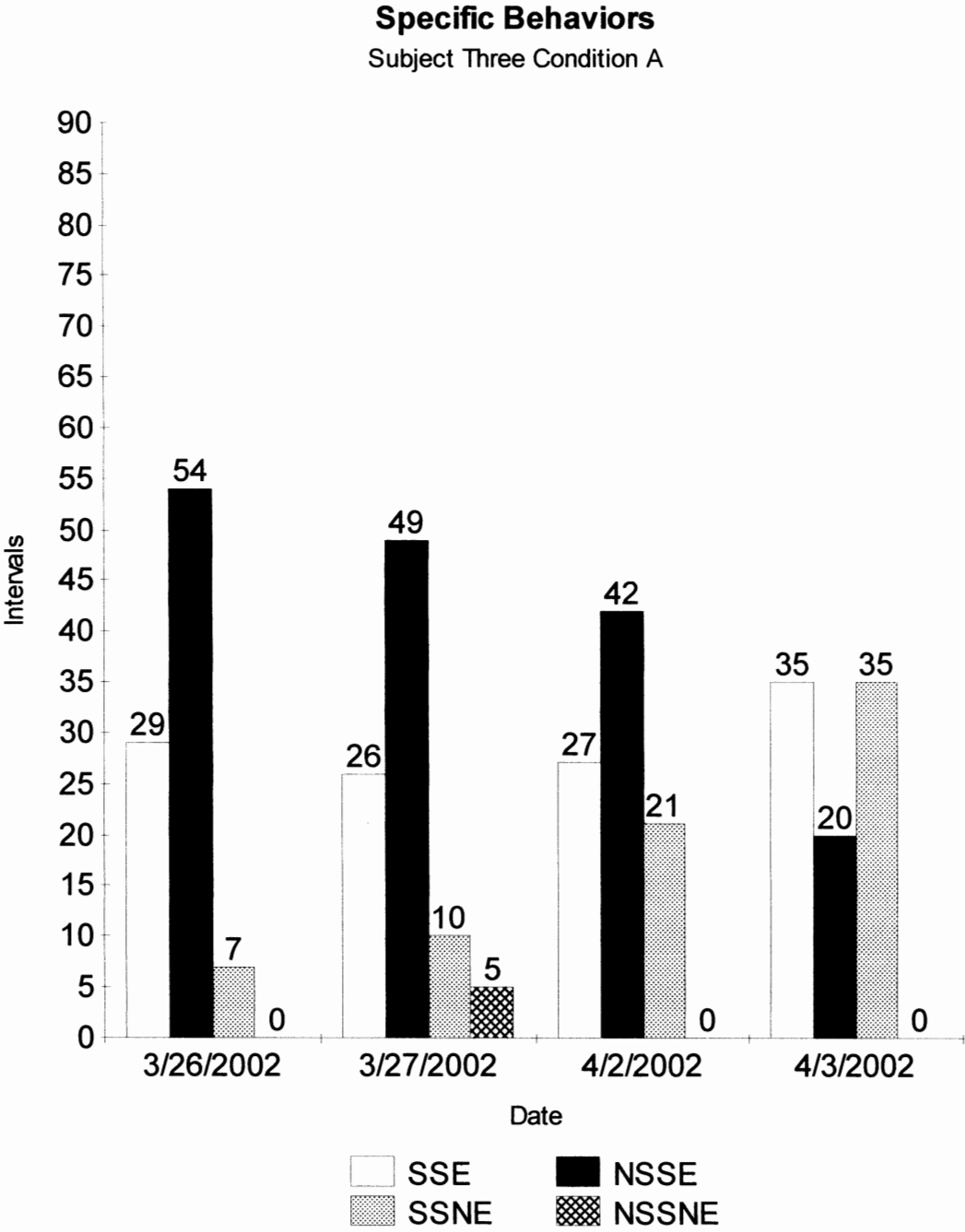


Figure 13. The specific behaviors displayed by Subject Three during Condition A.



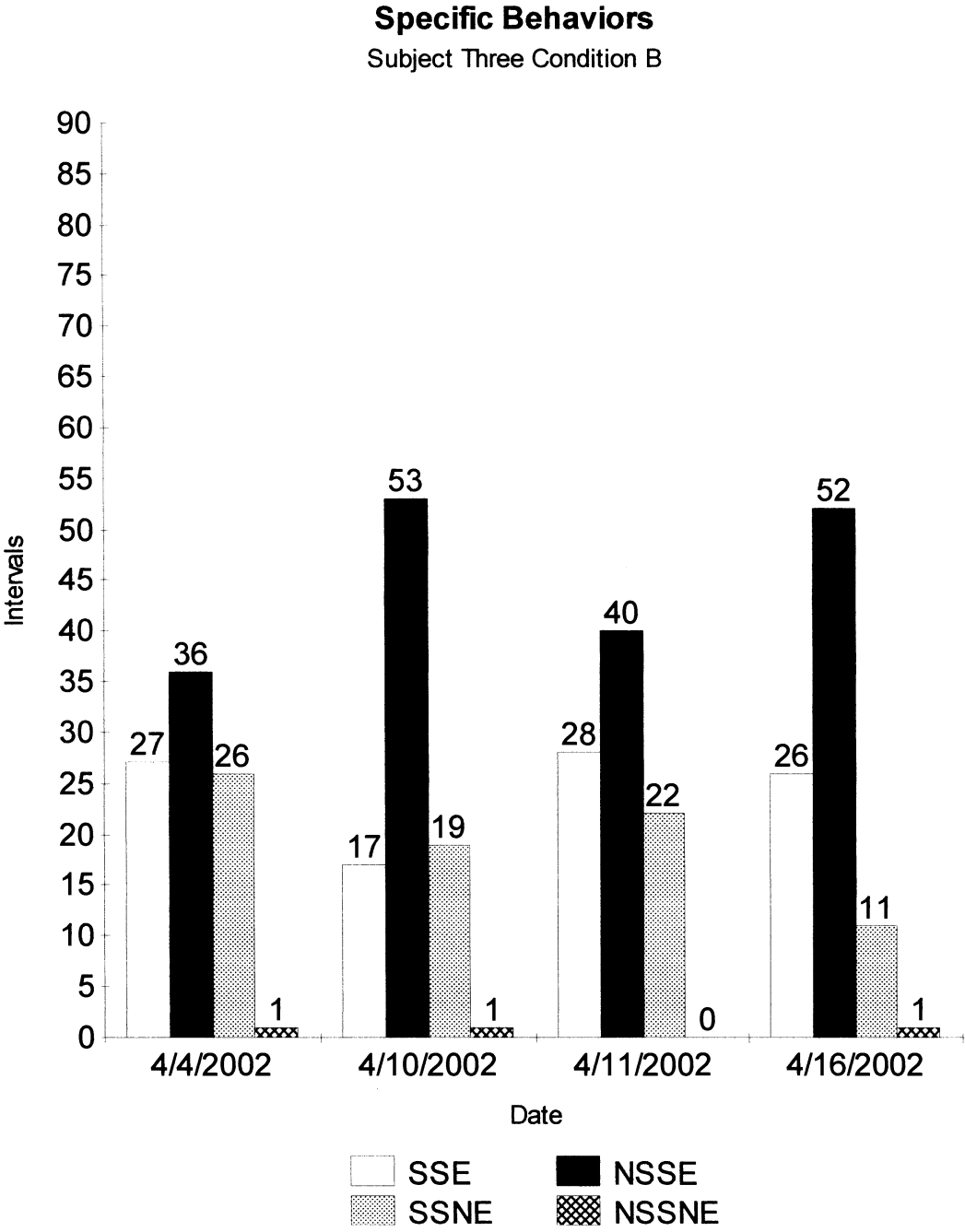


Figure 14. The specific behaviors displayed by Subject Three during Condition B.

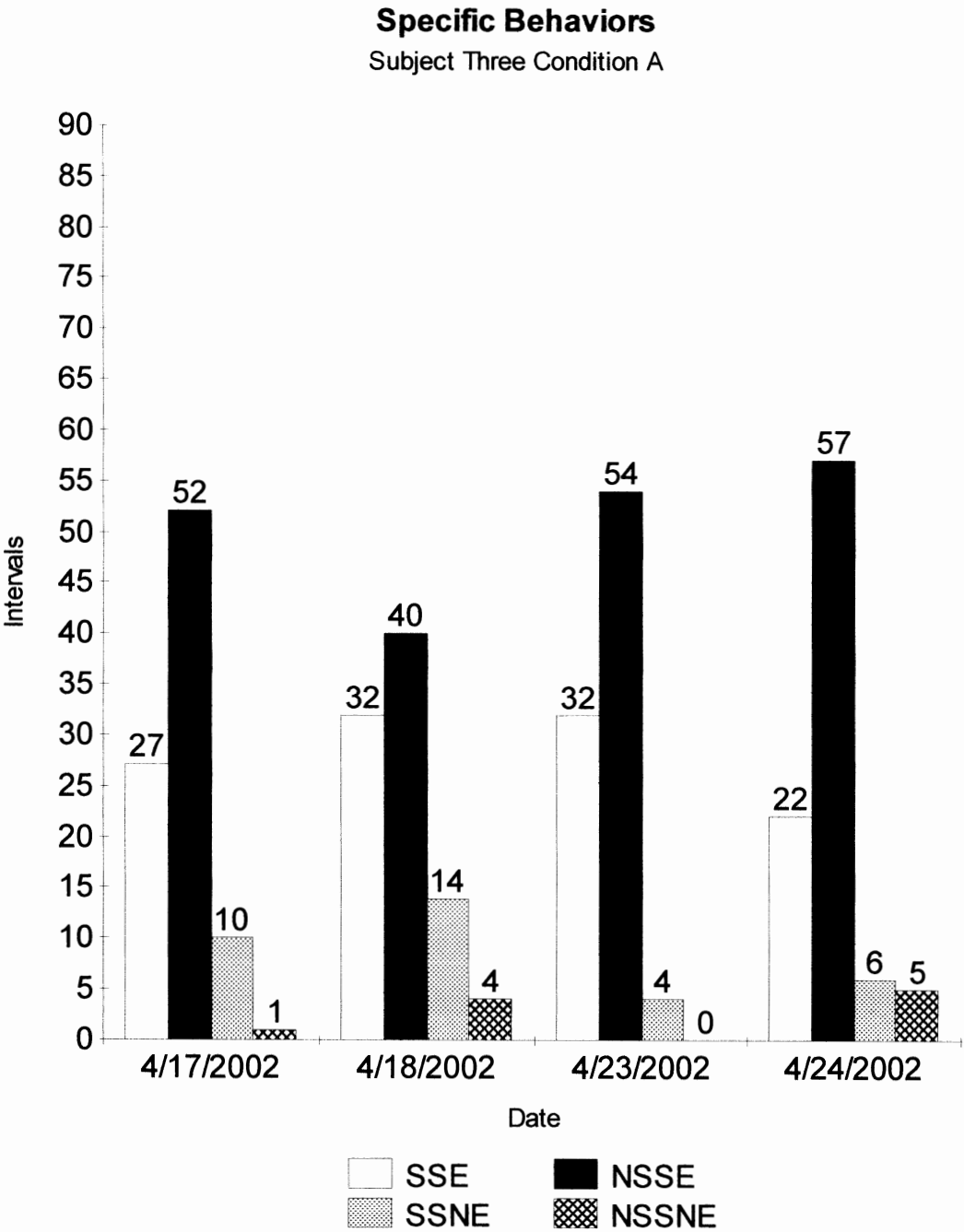


Figure 15. The specific behaviors displayed by Subject Three during Condition A again.

When NSSE is compared to NSSNE, the data collected for Subject three show that in Condition A, Subject three demonstrated a dominant behavior of NSSE behavior four out of four research days. In Condition B, Subject three demonstrated a dominant behavior of NSSE behavior four out of four research days. In Condition A again, Subject three demonstrated a dominant behavior of NSSE four out of four research days. When NSSE and NSSNE are compared for Subject three across all Conditions, Subject three demonstrated a dominant behavior of NSSE with more intervals during more research days than NSSNE, and demonstrated engagement over non-engagement in an activity while not self-stimulating. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did not influence the number of intervals expressing the amount of engagement or non-engagement in an activity Subject two did while not self-stimulating.

When SSE is compared to NSSE, the data collected for Subject three show that in Condition A, Subject three demonstrated a dominant behavior of NSSE three out of four research days. In Condition B, Subject three demonstrated a dominant behavior of NSSE four out of four research days. In Condition A again, Subject three demonstrated a dominant behavior of NSSE four out of four research days. When SSE and NSSE are compared for Subject three across all Conditions, Subject three demonstrated a dominant behavior of NSSE with more intervals during more research days than SSE, and demonstrated non self-stimulation over self-stimulation while being engaged in an activity. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity minimally influenced the

number of intervals expressing the amount of self-stimulation or non self-stimulation Subject three did while engaged in an activity.

When SSNE is compared to NSSNE, the data for Subject three shows that in Condition A, Subject three demonstrated a dominant behavior of SSNE four out of four research days. In Condition B, Subject three demonstrated a dominant behavior of SSNE four out of four research days. In Condition A again, Subject three demonstrated a dominant behavior of SSNE four out of four research days. When SSNE and NSSNE are compared for Subject three across all Conditions, Subject three demonstrated a dominant behavior of SSNE with more intervals during more research days than NSSNE, and demonstrated self-stimulation over non self-stimulation while being non-engaged in an activity. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did not influence the number of intervals expressing self-stimulation or non self-stimulation Subject three did while being non-engaged in an activity.

Subject three minimally decreased in the number of SSE behavior intervals from Condition A to Condition B, and from Condition B to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity minimally influenced the number of SSE behavior intervals of Subject three across Conditions. Subject three increased from Condition A to Condition B, and from Condition B to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity had a small influence on the number of NSSE behavior intervals of Subject three across Conditions. Subject three minimally increased in the number of SSNE behavior

intervals from Condition A to Condition B, and made a moderate decrease from Condition B back to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity had a small influence on the number of SSNE behavior intervals of Subject three across Conditions. Subject three minimally decreased in the number of NSSNE behavior intervals from Condition a to Condition B, and minimally increased in the number of NSSNE behavior intervals from Condition B to Condition A again when individual dates are looked at and compared, indicating that the introduction of an aerobic activity minimally influenced the number of NSSNE behavior intervals of Subject three across Conditions. Results of the data collected for Subject three indicates that the introduction of an aerobic activity minimally influenced Subject three's behavior.

Results are also reported for the categories that were extrapolated from the original data collection results. The categories of SS, NSS, E, and NE were looked at and compared (see Table 10 and Figures 16-18). The category of SS was compared to NSS, and the category of E was compared to NE across all Conditions of the study.

Table 10

Accumulated Intervals for General Behavior Categories for Subject Three

	CONDITION A				CONDITION B				CONDITION A			
SS	36	36	48	70	53	36	50	37	37	46	36	28
NSS	54	54	42	20	37	54	40	53	53	44	54	62
E	83	75	69	55	63	70	68	78	69	72	86	79
NE	7	15	21	35	27	20	22	12	11	18	4	11
DATE	3/26	3/27	4/2	4/3	4/4	4/10	4/11	4/16	4/17	4/18	4/23	4/24
RESEARCH DAY	1	2	3	4	5	6	7	8	9	10	11	12

Note. SS = Self-Stimulating  
NSS = Not Self-Stimulating  
E = Engaged  
NE = Not Engaged

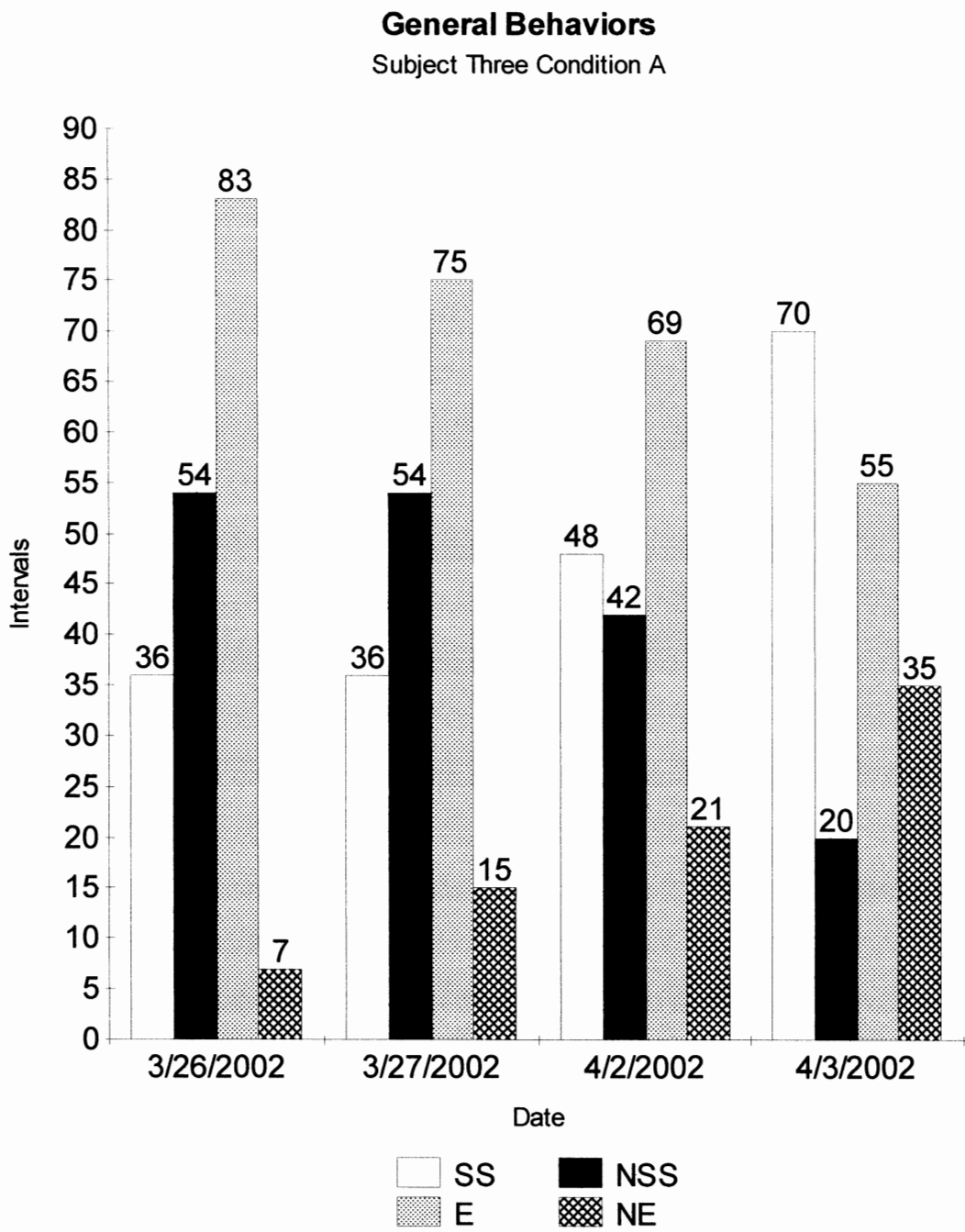


Figure 16. The general behaviors displayed by Subject Three during Condition A.

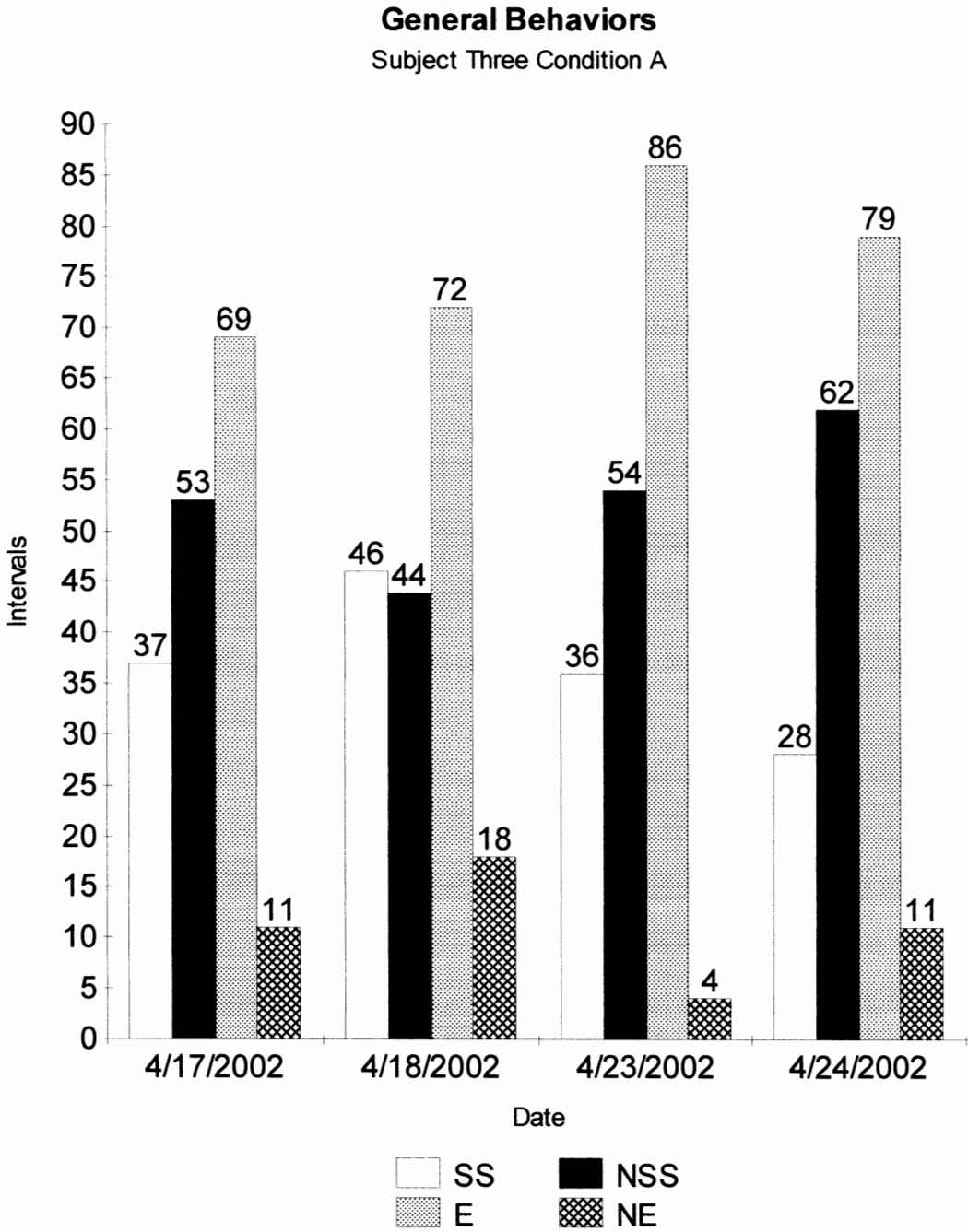


Figure 18. The general behaviors displayed by Subject Three during Condition A again.



When SS was compared to NSS, the data collected for Subject three show that in Condition A, Subject three demonstrated no dominant behavior as SS and NSS both were demonstrated two out of four research days, and a dominant behavior of E four out of four research days. In Condition B, Subject three demonstrated no dominant behavior as SS and NSS both were demonstrated two out of four research days, and a dominant behavior of E four out of four research days. In Condition A again, Subject three demonstrated a dominant behavior of NSS three out of four research days, and a dominant behavior of E four out of four research days. When SS and NSS are compared for Subject three across all Conditions, Subject three demonstrated non self-stimulating behavior minimally more with more intervals during more research days than self-stimulating behavior. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity minimally influenced the self-stimulating behaviors of Subject three. Self-stimulation remained consistent from Condition A to Condition B when individual dates are looked at and compared. However, Subject three did surpass the previous A Condition SS level minimally by adding an additional research day when the aerobic level was eliminated and a return to the non-aerobic Condition was resumed. Comparison results also showed that when E and NE are compared for Subject three across all Conditions, Subject three demonstrated engaged with more intervals during more research days than non-engaged behavior in an activity. Results also indicated that when comparing the Conditions (A-B-A), the introduction of an aerobic activity did not influence the engaged or non-engaged behaviors in an activity for Subject

three across Conditions. Engagement in an activity was consistently dominant across all Conditions, maintaining four out of four research day dominance in all Conditions.

As self-stimulation remained constant from Condition A to Condition B (with two out of four research days from Condition A and Condition B), engagement in an activity also remained constant from Condition A to Condition B (with four out of four research days for Condition A and Condition B). From Condition B to Condition A again, self-stimulating behavior increased (from two out of four research days to three out of four research days), while engagement in an activity remained constant (with four out of four research days from Condition A to Condition B). Results of the data showed no ability of self-stimulation to predict Subject three's engagement in an activity. Results of the data for Subject three indicated that the introduction of an aerobic activity did little to influence Subject three's behavior across Conditions.

## CHAPTER 5

### DISCUSSION, CONCLUSION, AND IMPLICATIONS

The purpose of the current study was to observe the effects aerobic activity had on reducing the self-stimulating behaviors of children diagnosed with autism. Results of the current study indicated that the introduction of an aerobic activity had a minimal effect for Subject one, and a minimal to non-existent effect for Subject's two and three in reducing self-stimulating behaviors.

#### Condition A Heart Rates

In Table 1 and Appendix A, the heart rate for each subject in both A (non-aerobic) Conditions appear to be close to express a max heart rate approaching the bottom limit of what was considered to be an aerobic heart rate for each subject. The researcher had several hypotheses as to why all three subjects had elevated heart rates during both A Conditions. One hypothesis to explain the elevated heart rates may be due to a physiological reaction the subject had in response to the novelty of participating in the study and the change in schedules as a result of their participation in the study.

A second hypothesis could be that many natural human emotions could explain the physiological reaction of elevated heart rates for all three subjects such as anxiety, fear, anger, excitement, joy, or embarrassment. These natural emotions could explain the elevated heart rates in all three subjects absent an aerobic activity. The researcher felt that the elevated heart rates displayed in all three subjects may be due to these natural emotions since all three subjects displayed the same elevation in heart rates.

A third hypothesis could be that the activity completed in the gym by the three subjects during the non-aerobic Conditions was in fact an activity enough in intensity to elevate the heart rates past resting heart rate levels and to approach the bottom limit of the individually calculated maximum heart rate.

The three subjects in the study communicated with the use of picture or object schedules and were not able to verbally express any emotions or feelings they may have had in regards to participating in the study. The researcher did observe physical characteristics that may have been indicative of natural emotions mentioned earlier. Subject one would turn away from the researcher, run away from the researcher, or push the researcher away. Subject two would turn away from the researcher, walk away from the researcher, or push the researcher away. Subject three would stomp her foot on the ground or insist on large amounts of space between her and the researcher.

Although there was consistency in the use of the treadmill to elevate the heart rates of the three subjects, there was no consistency in the activities the subjects would do during the non-aerobic activity in the gymnasium. During the non-aerobic Conditions of the study, Subject one would play on a jungle gym both inside and outside, swing on a swing inside or outside, or roll a ball back and forth with the researcher. Subject two would ride a three-wheeled bike in the gym or around the school building outside, or swing on a swing outside. Subject three would roll a giant therapy ball back and forth with the researcher, swing on the swing outside, or hit a beach ball back and forth with the researcher.

### Comparison to Previous Research

The results of the current study are compared to results obtained by professionals in previous studies. As cited by Rosenthal-Malek and Mitchell (1997), the self-stimulating behaviors of children diagnosed with autism interfere with positive social interactions and learning performance (Bass, 1985; Kern et al., 1982; Sugai & White, 1986). The articles chosen for comparison against the current study were articles that best matched the current study in methodology and design. The articles are compared in chronological order and not order of importance, as all the articles compared below had equal weight in bringing important concepts and characteristics to the studies and the hypothesis of exercise reducing stereotypical behaviors in children diagnosed with autism.

In the study by Waters and Waters (1980), five male subjects diagnosed with autism were placed in three preconditions (typical academic activities, television watching, and 8-10 minutes of jogging in the schoolyard). Following one of the three conditions the subjects were observed in language sessions. The order in which subjects were observed was determined by a randomized sequence. The observations of the subjects was done with the first five seconds devoted to Subject one, the next five seconds to Subject two, and so on until the language session had ended. The session length was not predetermined and constant, with subject's observation intervals ranging from 8-13 per session. The number of language sessions in the study was 27, with all five subjects participated in the language sessions at once following one of the preconditions. The language sessions consisted of an auditory-visual matching-to-sample task, with which the children were familiar. Verbal and

food reinforcers were given to subjects when correct responses to questions were given, redirection and verbal praise were given to children making incorrect responses. The results of the study showed a 32.7% decrease in self-stimulating behaviors on the average for all participants. Looking at individual subject's percentage of self-stimulating behaviors following the academic condition and the physical exercise precondition, it clearly shows all subjects reducing their self-stimulating behaviors following the exercise precondition compared to the academic precondition.

The current study used only three subjects, compared to Watters and Watters (1980), who used five Subjects. The results are no more generalizable in the study by Watters and Watters since there is little difference between three and five subjects. Watters and Watters reported the IQ of the subjects, which the current study did not. The IQ of the subjects in the current study was not reported due to the fact that all the subjects had previously been diagnosed with autism and severe or profound mental retardation, as well as and communicated by the use of a picture or object schedule (no verbal communication) and needed much support in managing daily life skills and activities. Watters and Watters placed all five subjects in the language session together, and in the current study each subject was worked with individually. The behavior of autistic children can be unpredictable and very hard to manage; yet no report was made of how all five children were managed in the language session by Watters and Watters.

Watters and Watters (1980) used a unique recording method for recording the self-stimulating behavior of all five subjects. Five-second intervals were assigned to

subjects as to when their behavior would be recorded. This unique recording method may have saved time, however, it does not fully represent the behavior of the subject during the language session. Subjects could have not self-stimulated during the five-second interval in which they were being observed and then self-stimulated the rest of the time. What was recorded was the subject not self-stimulating for that five-second interval, but the correct representation of the child's behavior would be self-stimulation during the language session. The current study worked with each subject individually, guaranteeing focused attention on one subject at a time. The current study also made a judgment call on the best representation of the subject's behavior for a given ten-second interval. In the current study, a set percentage and time was set aside as determining what the best representation of the child's behavior for a given ten-second interval. In Watters and Watters, the subjects were observed for an average of 10.8 times per language session, which is equivalent to an average of 54 seconds of observation per subject per language session. In the current study each subject was individually observed for a total of 15 minutes per research day following a non-aerobic or aerobic Condition. The current study increased the observation time beyond that which Waters and Watters observed, giving a better representation of the subjects behavior following a Condition

In the current study a further examination of the subject's engagement in an activity was made. The addition of recording the number of correct answers in Watters and Watters (1980) and the recording of the engagement or non-engagement in the current study may have taken away from the actual purpose of the study. Although the information is valuable, it does take extra time and effort to figure the

average percent correct answers, and whether a subject was engaged or not engaged in an activity.

Watters and Watters (1980) reported that the physical activity they chose to conduct the subjects through was 8-10 minutes of jogging in the schoolyard. The current study used the activity of 20 minutes of aerobic activity on a treadmill. The current study had subjects complete the aerobic activity for 20 minutes with heart rates taken every five minutes to ensure the subjects heart rates were consistently at an aerobic level as defined. Watters and Watters report no way of measuring the subjects physical activity level in the study, which raises the questions of how much physical activity individual subjects actually completed, and how the researchers knew that each subject truly was at an aerobic level.

Watters and Watters (1980) reported that in the initial half of the study subjects had to be dragged by teachers to participate in the jogging, and in the later half of the study all subjects were participating in the jogging with minimal prompting, which raises the question of how the teachers motivated the subjects to complete the jogging activity. The current study reports that verbal praise was the only prompting and motivation tool used as the subjects completed the aerobic activity on the treadmill. Watters and Watters do not report how they motivated the children to jog for the set amount of time. The researcher would like to know how Watters and Watters motivated the subjects to participate in the jogging. If subjects in the study by Watters and Watters were given any reinforcers for participating in the jogging portion of the study Watters and Watters cannot state that the introduction of an aerobic activity solely reduced the self-stimulating behaviors of the subjects.



Watters and Watters (1980) found that, on average, subjects decreased in self-stimulating behavior following the exercise condition as compared to following the academic condition. In the current study, a minimal reduction in self-stimulating behavior can be seen in Subject one from Condition A to Condition B, and a rise in self-stimulating behavior from Condition B to Condition A again. Results indicated that the introduction of an aerobic activity had a minimal effect on reducing the self-stimulating behavior of Subject one. The introduction of an aerobic activity had no effect on reducing the self-stimulating behaviors in Subject two. As the results show, Subject two maintained a consistent demonstration of self-stimulating behavior across all Conditions, demonstrating self-stimulating behaviors four out of four research days across all Conditions. The introduction of an aerobic activity had a no effect on reducing the self-stimulating behaviors in Subject three. As the results show, Subject three maintained a consistent demonstration of splitting the research days (two out of four research days) for both Condition A and Condition B. Subject three did increase self-stimulating behaviors from Condition A to Condition B (from two out of four research days to three out of four research days).

Watters and Watters (1980) demonstrated that children diagnosed with autism showed a reduction in self-stimulating behavior following an exercise precondition. As the current study results show, only a minimal effect can be seen in only one subject that the introduction of an aerobic activity had the desired effect of reducing self-stimulating behavior in children diagnosed with autism.

Kern, Koegel, Dyer, Blew, and Fenton (1982) completed a study using seven children diagnosed with autism and having high levels of self-stimulating behaviors.

Kern et al. report in depth on the functional capabilities of the subjects in their study. As in the current study, Kern et al. used subjects with high levels of self-stimulating behaviors and very low functional capabilities.

Kern et al. (1982) had subjects jog 5-10 minutes in the initial sessions, with the time being increased to 20 minutes in later sessions. The current study asked the students to participate in a non-aerobic activity Condition or an aerobic activity Condition for 20 minutes every research day. The non-aerobic activity varied for each subject and was not one consistent activity that all subjects participated in. The aerobic activity all three of the subjects in the current study participated in was 20 minutes on the treadmill to elevate the subject's heart rates to an aerobic level as defined earlier. The study by Kern et al. did not maintain a consistent time of aerobic activity, starting the study by having the subjects jog 5-10 minutes and gradually increasing it to 20 minutes. One advantage that Kern et al. have over the current study is varying times at which the subjects participated in the jogging activity. Looking at the data collected by Kern et al. one could compare the shorter time periods of jogging to the longer time periods of jogging to see which length of time produced the most effect.

Kern et al. (1982) recorded self-stimulating behaviors for 15 minutes before and 15 minutes after the jogging sessions. The subjects in the study ran by Kern et al. were measured in three settings. The settings were the effects of jogging on ball-playing and self-stimulation, academic tasks and self-stimulation, and not engaged in potentially incompatible behaviors. In the current study, subjects were placed into two different Conditions (non-aerobic or aerobic). After the subject had completed

the Condition the subject was observed in the classroom for the demonstration of the dominant behavior in ten-second intervals for 15 minutes. The effects of the introduction of a non-aerobic or aerobic activity were recorded in the subject's regular classroom. Self-stimulation and engagement in an activity were recorded for each student during the observation time.

Kern et al. (1982) recorded no physiological data for subjects in the study. subjects were regarded as being strenuous based on observable characteristics such as flushed face or increased breathing rate. The current study measured each individual subject's heart rate every five minutes and recorded the subject's heart rate. Subjects were considered to be in an aerobic state if their heart rate was above a specific number of beats per minute, individually calculated for each subject using a formula cited in Lochbaum and Crews (1995) by the American College of Sports Medicine (1990). See Chapter 3 section titled Heart Rate for the formula used to calculate individual Subjects bottom and upper limit heart rates. Subject one maintained an average heart rate of 143.125 during Condition B. Subject two maintained an average heart rate of 152.75 during Condition B. Subject three maintained an average heart rate of 149.375 during Condition B. Showing that all subjects were able to average a heart rate considered to be in the aerobic level during Condition B.

The results of the study by Kern et al. demonstrated that jogging decreased self-stimulating behaviors and indirectly increased other appropriate behaviors. This effect can minimally be seen in Subject one of the current study. As Subject one's self-stimulation decreased from Condition A to Condition B, engagement in an activity increased from Condition A to Condition B. When the aerobic activity was

eliminated and a return to baseline Condition was resumed, Subject one increased in self-stimulating behavior and decreased in engagement in an activity.

Kern, Koegel, and Dunlap (1984) completed a study using three subjects diagnosed with autism. Kern, Koegel, and Dunlap looked at the effects of a mild exercise compared to a vigorous exercise on the self-stimulating and on-task behaviors of children diagnosed with autism. Subjects were placed in a daily baseline condition (60-minute observation), followed by one of two conditions (jogging or playing ball). Subjects participated in the condition for 15 minutes followed by a 90-minute observation in the experimental setting. Subjects were then placed in the other condition for 15 minutes, followed by a 90-minute observation. Finally the child was placed back in the original condition for 15 minutes, followed by a 90-minute observation. Condition order was balanced so the first condition presented per day was alternated across days and children. In the current study, subjects participated in a Condition of non-aerobic or aerobic followed by a 15-minute observation. All Subjects started the study with a non-aerobic Condition. After having four research days of non-aerobic heart rate levels the child was moved to an aerobic Condition. Once the subject reached four consecutive research days of aerobic heart rate levels the subject was then moved back to a non-aerobic Condition. Kern, Koegel, and Dunlap completed much more observation than the current study. The researcher is curious about the carryover effect of conditions having an effect on the other conditions following them. Subjects in the study by Kern, Koegel, and Dunlap were placed through a vigorous exercise (jogging) for 15 minutes. Subjects were deemed to be at a vigorous exercise level when Subjects displayed observable

physical characteristics, such as a flushed face and an increased breathing rate. Subjects jogged with an adult (naïve to the experimental hypothesis) side by side. Subjects were allowed to walk for 15 seconds if they displayed observable signs of discomfort. In the current study, subject's heart rates were measured every five minutes during the non-aerobic or aerobic Condition. Subjects were deemed to be at aerobic heart rate levels if they were above a specific number figured for that specific subject. In the current study, the researcher used the subject's form of communication (picture or object schedule) to communicate what the subject was to do for an activity in a given Condition. Verbal praise and redirection were used all the time, with physical redirection used at times. Even with communicating in the manner in which the subject understood the best, there were times when it was difficult to get the subjects to initially participate in the aerobic activity. All subjects in the current study were very glad to be done with the aerobic activity when it was over.

The researcher is curious as to how the subjects in the study by Kern, Koegel, and Dunlap (1984) reacted to having a stranger jog with them side by side. Another question is how reliable is the adult jogging with the subject in making sure the subject completed a full 15 minutes of jogging without stopping? The same question could be asked about the current study, with the only answer being good faith on the part of the researchers and the adult. Kern, Koegel, and Dunlap divided the 60-minute and 90-minute observation times into 15-minute blocks, using a time-sampling procedure in which 15-second intervals were divided into 5 seconds of observation and 10 seconds of data recording. The presence or absence of stereotypic

behavior was recorded on data sheets. The study ran for two days with results showing that vigorous exercise systematically produced decreases in stereotypic behavior. The information obtained in the study enhanced the professional literature by showing that the type of exercise may have an impact on the behavior of children diagnosed with autism. All subjects in the current study achieved aerobic level heart rates from walking on a treadmill. The researcher would not describe walking on the treadmill as a vigorous exercise, however all subjects did achieve aerobic heart rates. The current study showed minimal to no effect of introducing an aerobic activity on the reduction of self-stimulating behaviors in children diagnosed with autism. The study by Kern, Koegel, and Dunlap did not provide heart rates for individual subjects, so it is hard to decide if the subjects in their study were equal to or surpassed those heart rates in the current study. As stated earlier, the researcher does not feel that walking on a treadmill is a vigorous exercise, and therefore, if it is not a vigorous exercise, the current study also adds to the professional literature with the results showing that mild exercise has little or no effect on influencing the stereotypic behavior of children diagnosed with autism.

A study completed by Levinson and Reid (1993) looked at the intensity of the exercise program on stereotypic behavior of children diagnosed with autism. The study used three subjects, two male and one female, from a special education school specifically to meet the needs of a child with autism. The study lasted 9 weeks and consisted of three phases. The first phase was establishment of baseline for all behaviors. The second phase was the treatment, the administration of mild and vigorous exercise programs. The third phase was a return to baseline. Before

implementing the treatment, a 45-minute observation time was completed to establish the frequency of stereotypic behaviors for that particular day. This was done to assess the reliability of baseline. Subject's heart rates were measured before and after the exercise programs by the researcher monitoring the radial pulse. Heart rate was measured one minute prior to exercise and over one minute following exercise. In the current study, subjects heart rates were measured and recorded every five minutes during the 20-minute non-aerobic and aerobic activity to make sure subjects were consistently at a heart rate considered to be either non-aerobic or aerobic. Reviewing the table of heart rates for the subjects in the study by Levinson and Reid, it is apparent the post mild exercise heart rates for two of the five subjects were higher than the other three subjects post mild exercise heart rates. Levinson and Reid offer no explanation as to why this may be. The current study also found all three subjects to have higher than anticipated non-aerobic heart rates. See early in Chapter 5 of the current study for several of the researcher's hypotheses as to why the non-aerobic heart rates were higher than anticipated for all three of the subjects. The subjects were placed in the mild and vigorous exercise programs and then observed for 15 minutes following the treatment implementation. The mild exercise program consisted of 15 minutes of walking and the vigorous exercise program consisted of 15 minutes of jogging. The mild exercise program was conducted with all participants in a group and the vigorous exercise was conducted with individual Subjects. The current study conducted all subjects through the Conditions individually, no group administration of any Condition in the current study occurred. The study by Levinson and Reid (1993) utilized a consistent mild exercise and a consistent vigorous exercise

in the two conditions for all subjects guaranteeing that all subjects completed the mild and vigorous exercise conditions with the same exercises. The current study was not consistent in its use of a non-aerobic activity that was the same for all subjects during the non-aerobic Conditions. Heart rates were measured and recorded for all subjects during the non-aerobic Condition to make sure the subjects were not exerting themselves so much as to elevate their heart rates to an aerobic level. The heart rates measured and recorded every five minutes during the non-aerobic Conditions for all three for the subjects in the current study is the only consistent element of the non-aerobic Condition.

Subjects were also observed 1-1/2 hr following the treatment implementation for 30 minutes to establish duration of the treatment effects. The results of the study showed that vigorous exercise was effective in reducing stereotypic behaviors immediately after implementation. However, treatment effects return to baseline and was no longer evident 1-1/2 hr following the vigorous exercise program. The current study's procedure most matches the study by Levison and Reid. Levinson and Reid were able to design a strong study in their continuous and consistent measuring of behavior and heart rate. Levinson and Reid (1993) also saw subjects return to or exceed baseline stereotypic behaviors in the 90 minutes following the exercise programs. In the current study, Subject's one and three exceeded baseline research days for displaying self-stimulating behavior.

Elliot et al., (1994) also looked at the impact the intensity of exercise has on reducing the stereotypic behaviors of adults with autism and mental retardation. The study used six participants, three men and three women from a residential treatment



program for people with autism. The subjects in the study participated in one of three treatment sessions randomly assigned to the subjects. All subjects had their resting heart rate measured by a licensed psychiatric technician. Subjects were then taken to the control room and their behavior was observed and recorded for 30 minutes. During that time the subjects were allowed to structure their own activities with no interference from the researchers. Subjects then engaged in one of three conditions for 20 minutes (non-exercise, motor training activities, and vigorous exercise). Subject's heart rates were measured after the 20-minute condition and deemed to be at a vigorous aerobic level if subjects heart beats per minute were above 130. In the current study, heart rates were taken every five minutes of the non-aerobic or aerobic condition to demonstrate consistent heart rate levels. Heart rate can be increased in a relatively short amount of time (seconds) if doing the right activity. The results of the study by Elliott et al. show that the intensity of the activity is critical in reducing stereotypic and maladaptive behaviors in adults diagnosed with autism and mental retardation. Results showed that while motor activities did not reduce stereotypic and maladaptive behaviors, vigorous exercise did. In the current study, all participants achieved elevated heart rates above 130 beats per minute while walking on a treadmill in the aerobic Condition for 20 minutes, yet minimal or no reduction in self-stimulating behaviors was seen.

In the study by Elliott et al. (1994) the researchers used a concrete definition of vigorous exercise by recording a heart rate at the end of the 20-minute condition. Heart rates above 130 beats per minute were considered vigorous. The current study used a formula cited in Lochbaum and Crews (1995) created by the American

College of Sports Medicine (1990) to individually calculate the heart rates of each subject participating in the study. The study by Elliott et al. does not use a formula to calculate the heart rates of each individual subject participating in the study but instead states that a heart rate above 130 beats per minute is considered vigorous. The current study's approach to calculating heart rates for each subject participating in the study is more precise in creating an appropriate range for what is considered to be an aerobic heart rate for each individual subject. Elliott et al. are not incorrect for stating that 130 beats per minute is considered an aerobic heart rate, (although age is a factor in figuring the correct range for what is considered to be a aerobic heart rate) it is just not individualized for each subject participating in the study as it is in the current study. This information lends support to the professional literature in that even when a concrete definition of aerobic or vigorous is defined (as in a heart rate), subjects may not show a reduction in stereotypic (self-stimulating) and maladaptive behaviors.

A study by Rosenthal-Malek and Mitchell (1997) looked at the effects a mildly strenuous exercise program had on the self-stimulating behaviors of children diagnosed with autism. The study used five subjects, all male, from a special education class in a public school. The exercise program used in the study consisted of warm-up stretches and mildly strenuous jogging, which lasted for 20 minutes. Subjects were placed in the jogging condition at the beginning of the year to avoid behaviors due to a change in schedules, so the jogging was well established as a part of their daily routine. The subjects were deemed active if they displayed observable physical characteristics such as flushed faces and increased breathing rate. The

definition of vigorous exercise could be argued in the earlier article because the researchers based their determination of whether a subject was vigorously jogging on observable physical characteristics and not a concrete definition, such as heart rate. Another condition was an academic condition where the teacher worked on coin values with the subjects. Conditions were randomly assigned to subjects each day, and each subject completed both conditions in the same day. Following the completion of the condition the subjects were then taken to their regular classroom and observed for self-stimulating behaviors. Subjects were randomly observed for five seconds, then a second student was observed for five seconds, then a third, until all five boys were observed ten times. The results of the study by Rosenthal-Malek and Mitchell showed a significant decrease in self-stimulating behaviors following the exercise condition as compared to the academic condition. In the current study, all subjects were not introduced to the researcher or the researcher's intentions prior to the start date of the study, as was the case in the study completed by Rosenthal-Malek and Mitchell. Because subjects were introduced to the routine of the study before a solid routine of their own could be established, it may have helped the subjects respond better to the jogging condition of the study, and therefore the researchers may have been able to obtain better results. Data was not collected in the study by Rosenthal-Malek and Mitchell until one month after the subjects had already been exposed to the jogging condition. All subjects in the current study were individually observed for a total of 15 minutes following a non-aerobic or aerobic Condition. Rosenthal-Malek and Mitchell randomly observed subjects for five seconds and recorded the subject's behavior by giving a point every time an

individually defined behavior was displayed. The method of behavior recording Rosenthal-Malek and Mitchell chose may not have been the best representation of the subject's behavior for that time. Individual recordings of the subject's behavior would have given stronger results.

Many of the articles by other professionals used small numbers of subjects in their study. The current study also used a small number of subjects. This was done to obtain the best results for the study, and due to time constraints of collecting data. Using large numbers of children diagnosed with autism may not generalize any better due to the extreme individuality of the symptoms expressed by children diagnosed with autism. Children diagnosed with autism can be very hard to manage. Changes to schedules or set routines can set some children into fits of violent behavior channeled towards others or self. In being courteous to the symptoms displayed by some with autism, research conducted with small numbers of participants is the best manner in which to obtain the best results and avoid the expression of maladaptive behaviors.

Four out of the six articles that were compared to the current study had no concrete way of measuring the exercise intensity of the subjects. In those articles, the exercise intensity was simply measured by observable physical characteristics displayed by the subjects (such as flushed faces, or increased breathing rate). The researcher is skeptical about how the professionals came to the conclusions they did with no concrete way of measuring exercise intensity. A flushed face and increased breathing can be accomplished very quickly, and can be caused by other factors other than increased exercise intensity, such as physical reactions to normal human

emotions. The research that clearly states a concrete way of defining exercise intensity can make stronger claims about the treatments effectiveness.

Many studies reported the Subjects IQ score along with specific behaviors each subject demonstrated as being stereotypical or maladaptive. An IQ score can only tell so much about a child's intellectual and functional capabilities. All the subjects in the current study communicated by means of a picture or object schedule, and some sign language. All of the subjects in the current study had histories of maladaptive and/or violent behavior when agitated, or a change in schedule occurred. All subjects in the current study needed extra support managing daily life skills and activities, such as eating and toileting. None of the studies reported how researchers got the subjects to participate in the study. Many reported the subjects were "brought" to the treatment area or "taken" to a room. Subjects in the current study were transitioned by means of their picture or object schedules to all areas and to all activities.

### Conclusion

In conclusion, the introduction of an aerobic activity had a minimal to no effect on reducing the self-stimulating behaviors of children diagnosed with autism in the current study. When engagement and non-engagement were considered, the conclusion was that the introduction of an aerobic activity had minimal to no effect on increasing the engagement of children in the current study. A further conclusion can be made that self-stimulation did not predict whether two of the three subjects would be engaged or not engaged in an activity. Subject one results did show a minimal effect, and although the effect is minimal it does follow the expectation that

the introduction of an aerobic activity may reduce self-stimulation and increase engagement in an activity. Subject one did not exercise at a higher level or intensity as compared to Subject two and three. Perhaps the introduction of an aerobic activity as a treatment for the alleviation of self-stimulating symptoms is like other treatments that support the alleviation of the symptoms of autism in that it the treatment may work for some but not all people diagnosed with autism. The question as to why the difference in treatment effectiveness across people diagnosed with the same disorder (autism) is a question that related back to the mystery of the etiology of the disorder.

#### Difference in Obtained Results

Results of the current study do not match some results seen in previous professional literature. To answer the question as to why a match did not occur between the current study's results and previous professional literature many variables had to be compared. As was stated earlier, the methodologies for conducting research on reducing self-stimulating behaviors in children diagnosed with autism by the introduction of aerobic activity have all been different. The researcher consulted previous professional literature for suggestions on conducting a sound methodology and felt that the methodology the researcher conducted was appropriately similar. The researcher felt that the difference in the obtained results of the current study and the results of previous professional literature could be due to the fact that there truly is no effect between the introduction of aerobic activity and the self-stimulating behaviors of children diagnosed with autism.

### Implications for Future Research and Clinical Practice

This study was conducted to determine the effects the introduction of an aerobic activity had on self-stimulating and engaged behaviors. The results of the current study are not similar to what previous professionals have found. The methodologies conducted were different, but the theme of the research was the same.

The first implication for future research is that research be conducted on children diagnosed with different severities of autism. The current study used children who were severely autistic and severely and profoundly mentally retarded. Future research should focus on what severity level a treatment such as exercise has on children diagnosed with autism. Many of the studies in the past have reported the subjects IQ score. In future research the reporting of a Subjects IQ score should also be followed by an explanation of the subject's functional capabilities and the manner in which the subjects communicate. Children with different severity levels of autism may respond to the treatment differently.

A second implication for future research would be to develop a concrete form for which to record the behaviors of the subjects. In the current study, subject's behavior was recorded as the behavior the child demonstrated dominance in for the ten-second interval. Other professionals recorded every behavior in a given time frame. And yet others recorded behavior in another fashion. The development of a standardized form for which to record the behaviors would only give strength to the results in future studies.

A third implication for future research would be to test the theory on different ages of children diagnosed with autism. Professionals are limited to the population of

children diagnosed with autism. Further research in this area may provide information on whether age is or is not a factor in its effectiveness. However, further research is needed in the area of varying age ranges.

A fourth implication for future research would be to develop a concrete manner in which to deliver aerobic activity to those diagnosed with autism. Professional literature has yet to provide a concrete “correct” manner in which to deliver aerobic activity for which participants receive the most benefit from it. In future research it is suggested that researchers look at the many possible ways in which to deliver aerobic activities to observe which methods deliver the best results. A meta-analysis of aerobic activity options is in order to assess which delivery system of aerobic activities will provide the best results in reducing the self-stimulating behavior of children diagnosed with autism.

A fifth implication for future research would be the long-term management of effects of self-stimulating behavior with aerobic activity. In all studies reviewed, the effects of the aerobic activity ceased after a period of no longer than two weeks, and for some children the cessation of effects came immediately. Professional literature results support the fact that aerobic activity is a viable treatment for reducing the self-stimulating behaviors of children diagnosed with autism, which must be maintained for long-term results.

A final implication for future research would be to conduct the study in a medical setting where state of the art medical equipment could be used to measure the subject’s heart rate, and take blood samples to analyze for additional chemicals the body may be producing in excess. Medical equipment such as magnetic resonance



imaging (MRI), positive emission tomography (PET), and electroencephalograms (EEG's) can allow researchers to study the brains of children diagnosed with autism and show professionals the workings of the brain, which areas of the brain are active during the process of exercise. Since autism is strongly considered a brain-based disorder, further research in this area may provide new information on the etiology and treatments of autism. Although the use of such medical equipment would be helpful, professionals are cautioned that the subject(s) with autism may not respond well to the new environment and the medical equipment. A lengthy process of acclimation would be necessary to get subjects diagnosed with autism comfortable with the surroundings.

The results of this study cannot support the use of exercise as a treatment for reducing the self-stimulating behaviors of children diagnosed with autism. Subject one was the only participant that showed any effect in the direction of what past research had described.

All of the Subjects that participated in the current study did not care for the aerobic activity, and all were glad when it was finished. What the subjects did appreciate was the opportunity to engage in a physical activity to their liking. For Subject one, it was playing on the slide or the jungle gym outside. For Subject two, it was swinging outside. And for Subject three, it was taking a walk or swinging outside. These activities are not aerobic by nature or by definition (heart rate included), but the children did enjoy doing them.

With children who are high self-stimulators, as were the subjects in the current study, at times the high frequency of self-stimulation can take the child away

from an activity. These stereotypic behaviors can prevent a child from responding appropriately to the environment and interfere with previously learned behaviors (Bucher & Lovaas, 1968) and with learning (Koegel & Covert, 1972) as cited in Levinson and Reid (1993). Rosenthal-Malek and Mitchell (1997) cite professionals who have stated that displaying stereotypic behaviors can interfere with positive social behaviors and learning (Bass, 1985; Kern et al., 1982; Sugai & White, 1986) and can keep the child from being integrated into the regular education classroom (Van Bourgondien & Mesibov, 1989). Subject's engagement in an activity could not be predicted by the amount of self-stimulation in the current study.

Is it enough that a child diagnosed with autism is engaged in an activity, or is the cessation of the child's self-stimulating behavior a must? Professionals and caretakers should be aware of when to allow a child to be the child he/she is, and that trying to control a child's behavior by means of maximum restriction may cause more harm than good.

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## APPENDIX A

Heart Rates for Each Subject for Each Day Across All Conditions

SUBJECT ONE HEART RATES  
ACROSS CONDITIONS

CONDITION A																
HEART RATES	111	117	116	113	117	112	122	97	117	107	108	117	104	111	117	122
DATE	3/26/02				3/27/02				4/2/02				4/4/02			
RESEARCH DAY	1				2				3				4			

CONDITION B																
HEART RATES	144	146	146	150	134	140	142	143	133	134	144	144	139	144	148	159
DATE	4/9/02				4/10/02				4/11/02				4/16/02			
RESEARCH DAY	5				6				7				8			

CONDITION A																
HEART RATES	115	121	117	119	118	114	116	116	106	96	111	107	111	116	118	117
DATE	4/17/02				4/18/02				4/23/02				4/24/02			
RESEARCH DAY	9				10				11				12			

MEAN HEART RATE  
FOR EACH DAY AND CONDITION

	CONDITION A				MEAN HEART RATE FOR CONDITION A
MEAN HEART RATE	114.25	112	112.25	113.5	113
DATE	3/26/02	3/27/02	4/2/02	4/4/02	113
RESEARCH DAY	1	2	3	4	113

	CONDITION B				MEAN HEART RATE FOR CONDITION B
MEAN HEART RATE	146.5	139.75	138.75	147.5	143.125
DATE	4/9/02	4/10/02	4/11/02	4/16/02	143.125
RESEARCH DAY	5	6	7	8	143.125

	CONDITION A				MEAN HEART RATE FOR CONDITION A
MEAN HEART RATE	118	116	105	115.5	113.625
DATE	4/17/02	4/18/02	4/23/02	4/24/02	113.625
RESEARCH DAY	9	10	11	12	113.625

MEAN HEART RATE  
ACROSS CONDITIONS

	CONDITION A	CONDITION B	CONDITION A
MEAN HEART RATE FOR CONDITION	113 RANGE (97-122)	143.125 RANGE (133-159)	113.625 RANGE (96-121)



SUBJECT TWO HEART RATES  
ACROSS CONDITIONS

CONDITION A																
HEART RATES	122	117	118	117	108	101	117	105	112	120	105	115	117	112	108	121
DATE	3/26/02				3/27/02				3/28/02				4/2/02			
RESEARCH DAY	1				2				3				4			

CONDITION B																
HEART RATES	121	149	159	163	177	160	162	152	144	147	144	148	149	154	156	159
DATE	4/3/02				4/10/02				4/11/02				4/16/02			
RESEARCH DAY	5				6				7				8			

CONDITION A																
HEART RATES	108	117	109	111	105	111	114	109	106	111	112	111	112	113	117	117
DATE	4/17/02				4/18/02				4/23/02				4/24/02			
RESEARCH DAY	9				10				11				12			

MEAN HEART RATE  
FOR EACH CONDITION

	CONDITION A																MEAN HEART RATE FOR CONDITION A
MEAN HEART RATE	118.5				107.75				113				114.5				113.4375
DATE	3/26/02				3/27/02				3/28/02				4/2/02				113.4375
RESEARCH DAY	1				2				3				4				113.4375

	CONDITION B																MEAN HEART RATE FOR CONDITION B
MEAN HEART RATE	148				162.75				145.75				154.5				152.75
DATE	4/3/02				4/10/02				4/11/02				4/16/02				152.75
RESEARCH DAY	5				6				7				8				152.75

	CONDITION A																MEAN HEART RATE FOR CONDITION A
MEAN HEART RATE	111.25				109.75				110				114.75				111.4375
DATE	4/17/02				4/18/02				4/23/02				4/24/02				111.4375
RESEARCH DAY	9				10				11				12				111.4375

MEAN HEART RATE  
ACROSS CONDITIONS

	CONDITION A				CONDITION B				CONDITION A			
MEAN HEART RATE FOR CONDITION	113.4375				152.75				111.4375			
	RANGE (101-122)				RANGE(121-163)				RANGE(105-117)			

SUBJECT THREE HEART RATE  
ACROSS CONDITIONS

CONDITION A																	
HEART RATES	135	120	118	111	113	104	120	105	119	120	123	117	112	124	119	109	
DATE	3/26/02				3/27/02				4/2/02				4/3/02				
RESEARCH DAY	1				2				3				4				

CONDITION B																	
HEART RATES	138	140	140	142	138	136	146	156	149	156	158	155	150	161	161	164	
DATE	4/4/02				4/10/02				4/11/02				4/16/02				
RESEARCH DAY	5				6				7				8				

CONDITION A																	
HEART RATES	117	117	121	114	114	117	121	122	114	112	115	117	113	118	117	112	
DATE	4/17/02				4/18/02				4/23/02				4/24/02				
RESEARCH DAY	9				10				11				12				

MEAN HEART RATE  
FOR EACH CONDITION

	CONDITION A																MEAN HEART RATE FOR CONDITION A
MEAN HEART RATE	121				110.5				119.75				116				116.8125
DATE	3/26/02				3/27/02				4/2/02				4/3/02				116.8125
RESEARCH DAY	1				2				3				4				116.8125

	CONDITION B																MEAN HEART RATE FOR CONDITION B
MEAN HEART RATE	140				144				154.5				159				149.375
DATE	4/4/02				4/10/02				4/11/02				4/16/02				149.375
RESEARCH DAY	5				6				7				8				149.375

	CONDITION A																MEAN HEART RATE FOR CONDITION A
MEAN HEART RATE	117.25				118.5				114.5				115				116.3125
DATE	4/17/02				4/18/02				4/23/02				4/24/02				116.3125
RESEARCH DAY	9				10				11				12				116.3125

MEAN HEART RATE  
ACROSS CONDITIONS

	CONDITION A				CONDITION B				CONDITION A			
MEAN HEART RATE FOR CONDITION	116.8125				149.375				116.3125			
	RANGE (104-135)				RANGE (136-164)				RANGE (112-122)			

## APPENDIX B

### Data Collection Sheet for the Dominant Behavior

Name:  
Date:  
Classroom:  
Self-stimulating behavior:

	0-9	10-19	20-29	30-39	30-49	50-59
Self-stimulating behavior Engaged						
No self-stimulating behavior Engaged						
Self-stimulating behavior Not engaged						
No self-stimulating behavior Not engaged						

This template was duplicated 15 times which gives 15-minutes of observation data with the dominant behavior being recorded every ten seconds for a total of 90 ten-second intervals. The researcher marked the appropriate box based on the dominant behavior the Subject displayed for 60% of the time or greater (6 second or longer) during each ten-second interval.